

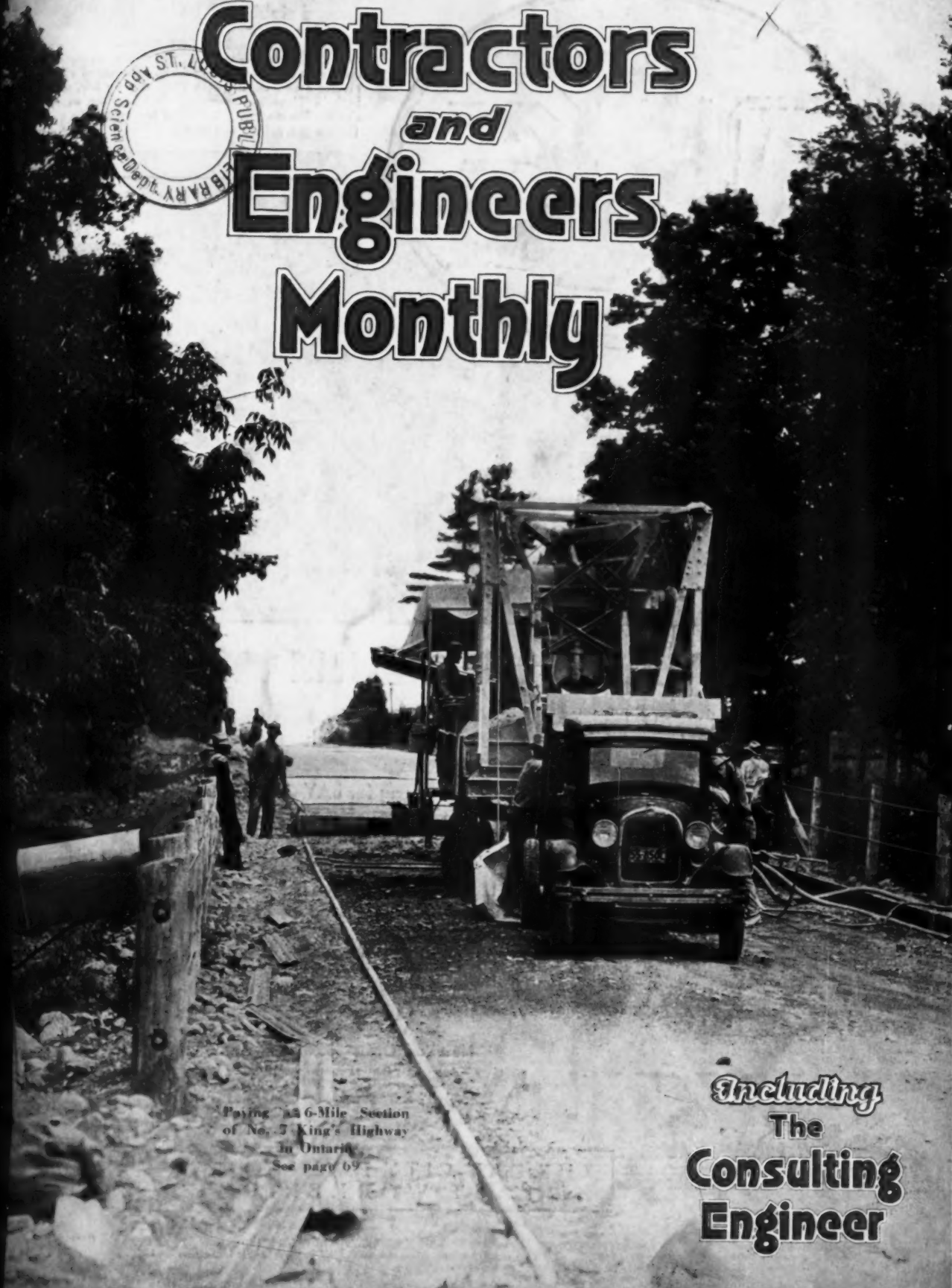
MARCH, 1931

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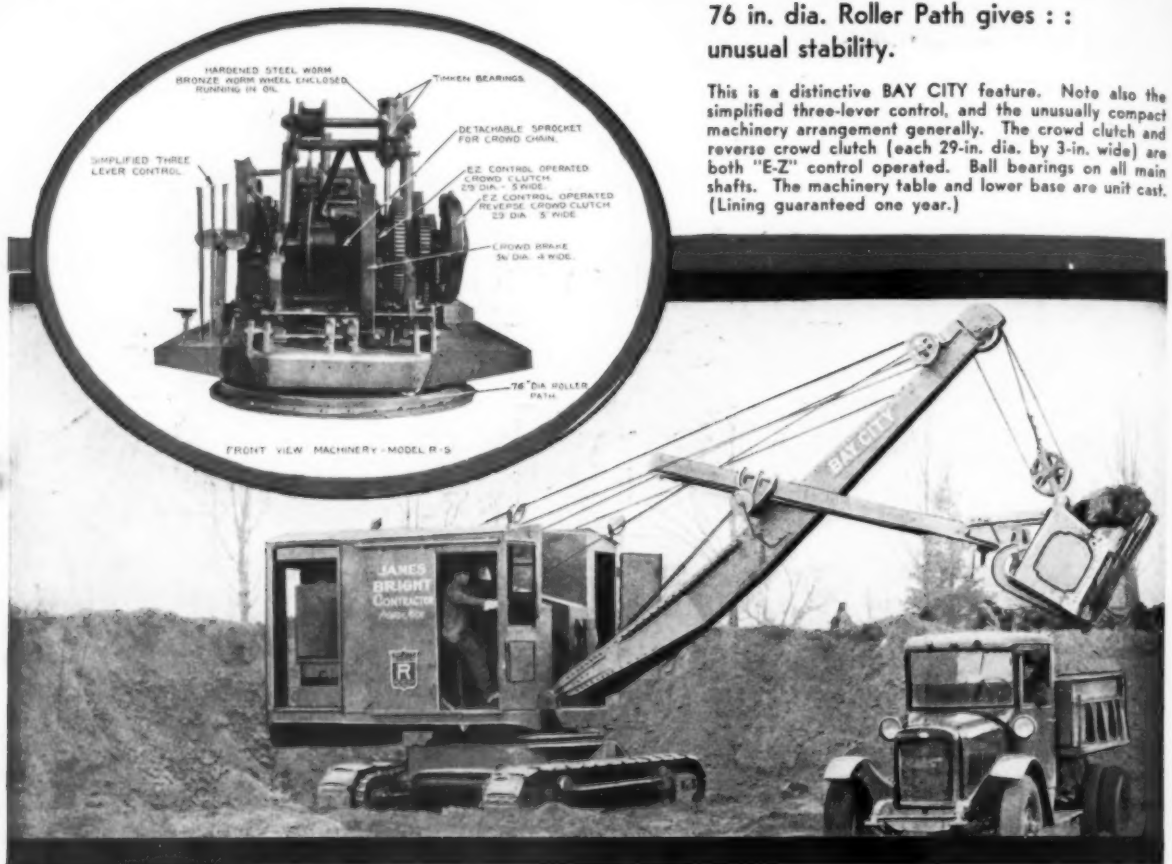


Contractors *and* Engineers Monthly



Paving a 6-Mile Section
of No. 7 King's Highway
in Ontario
See page 69

Including
The
**Consulting
Engineer**



76 in. dia. Roller Path gives : :
unusual stability.

This is a distinctive BAY CITY feature. Note also the simplified three-lever control, and the unusually compact machinery arrangement generally. The crowd clutch and reverse crowd clutch (each 29-in. dia. by 3-in. wide) are both "E-Z" control operated. Ball bearings on all main shafts. The machinery table and lower base are unit cast. (Lining guaranteed one year.)

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Bright contractors have always been strong for BAY CITY Shovels. Such men know that their speed, power, stability, adaptability and dependable service spell BIGGER profits.

The Model-R is a 26-ton full revolving shovel, convertible to crane, dragline, trencher, skimmer, etc. Light enough to move easily—heavy enough to stand up under continuous driving. The wide roller path prevents rocking.

The BAY CITY family of fast workers includes a machine for every job—from $\frac{3}{8}$ -yard to full size 1 yard. Catalog RS-4 covers Model-R.

BAY CITY SHOVELS, INC.

New York Office—302 Broadway BAY CITY, MICH.

BAY-CITY SHOVELS

THE BAY-CITY FAMILY
OF FAST WORKERS

Driving the Longest Continuous Rock Tunnel in the World

By
Roger W. Armstrong

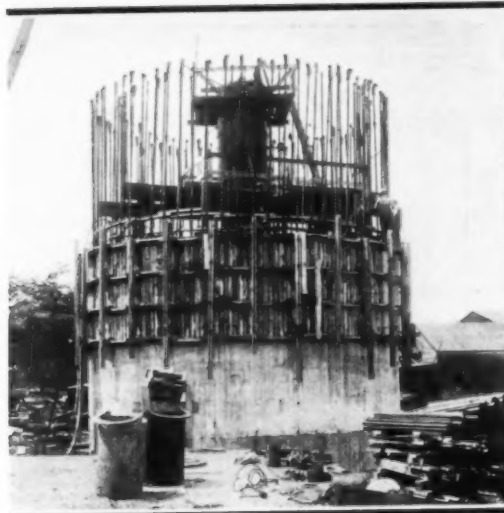
*Division Engineer
City Aqueduct Department*

* *Board of Water Supply, New York City*

THERE is now in progress under the City of New York the construction of what will be the longest continuous rock tunnel in the world. This project includes the sinking of 10,270 feet of shafts, of which 840 feet are in nine large pneumatic caissons; the excavation of 1,627,000 cubic yards of rock in the shafts and the 20 miles of tunnel and the placing of 642,000 cubic yards of concrete in shaft and tunnel linings. It includes also the building of fourteen subsurface valve chambers, 25 x 45 feet for housing the valves and piping of the distribution outlets; the substructures of two gate chambers, 115 x 66 feet, at Hill View Reservoir and the substructure of a combined valve and drainage chamber, 75 x 52 feet, on the south shore of the East River. The work is being carried on for the Board of Water Supply of the City of New York under four contracts, all of which were awarded to Patrick McGovern, Inc., 50 East 42nd Street, New York City, at a total estimated cost, based on the bid prices, of \$42,692,567.50.

LOCATION

This tunnel will be the second large artery for the distribution of water in the New York water supply system. The first, City Tunnel No. 1, extending from Hill View Reservoir in Yonkers, through the Bronx and Central Manhattan and then under the East River to



A Reinforced Concrete Caisson 28 Feet Inside Diameter, and with a Wall 4 Feet Thick, for a Combined Drainage and Delivery Shaft. This Shaft Was Sunk 21 Feet Below Ground Level as an Open Caisson and Then 41 Feet More Under Compressed Air

A Deep Pressure Tunnel

for the

Delivery of Water

to

New York City

Brooklyn, was started in 1912 and has been in service since 1917. City Tunnel No. 2, starting also at Hill View Reservoir, has a more easterly location, passing from the Bronx under the East River at Rikers Island, and thence through the Boroughs of Queens and Brooklyn to its terminus in the Red Hook section of South Brooklyn. The two tunnels with their interconnections at Hill View Reservoir and in the vicinity of Fort Greene Park, Brooklyn, will form a circuit which may be divided by gates and valves into four sections, any one of which may be isolated and drained for inspection or repair while the other three remain in service. In addition to this important function of safeguarding the present supply, the new tunnel will be of immediate service in effecting a much needed increase in pressures in the outlying districts of the easterly portion of the city and will ultimately become a necessary and im-

SHAFT HEADS

The temporary works at the shaft heads are, as far as practicable, of fireproof construction and, consequently, semi-permanent or almost permanent in character. The power houses, dry houses, offices and blacksmith shops are steel frame buildings with galvanized steel siding and concrete floors. The head-frames and hoist-houses are also of steel and the use of steel is extended down into the shafts where structural shapes have been substituted for the usual timbering for the support of cage guides and the construction of the man-ways.

STORAGE OF EXPLOSIVES

At the outset, the storage of explosives was necessarily at the surface, where first class magazines of 500-pounds capacity were approved and licensed by the New York Bureau of Combustibles. As soon as practicable in the progress of the work, however, underground magazine chambers were constructed and put in service. In these, storage of 2,000 pounds of explosives is permitted, which, with the frequent deliveries possible in the city, is ample for the requirements of the work.

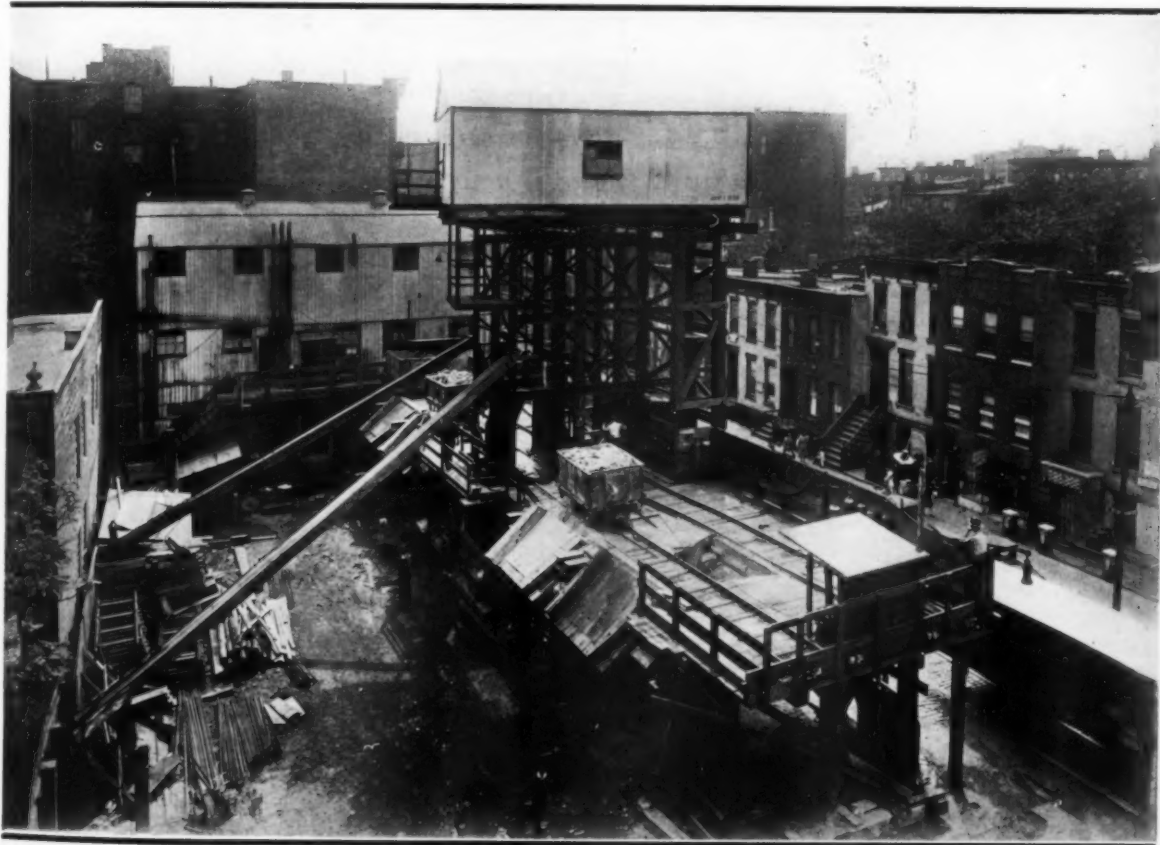
ELECTRIC POWER THROUGHOUT

The primary power for all work on the construction of shafts and tunnel is the high tension electric current

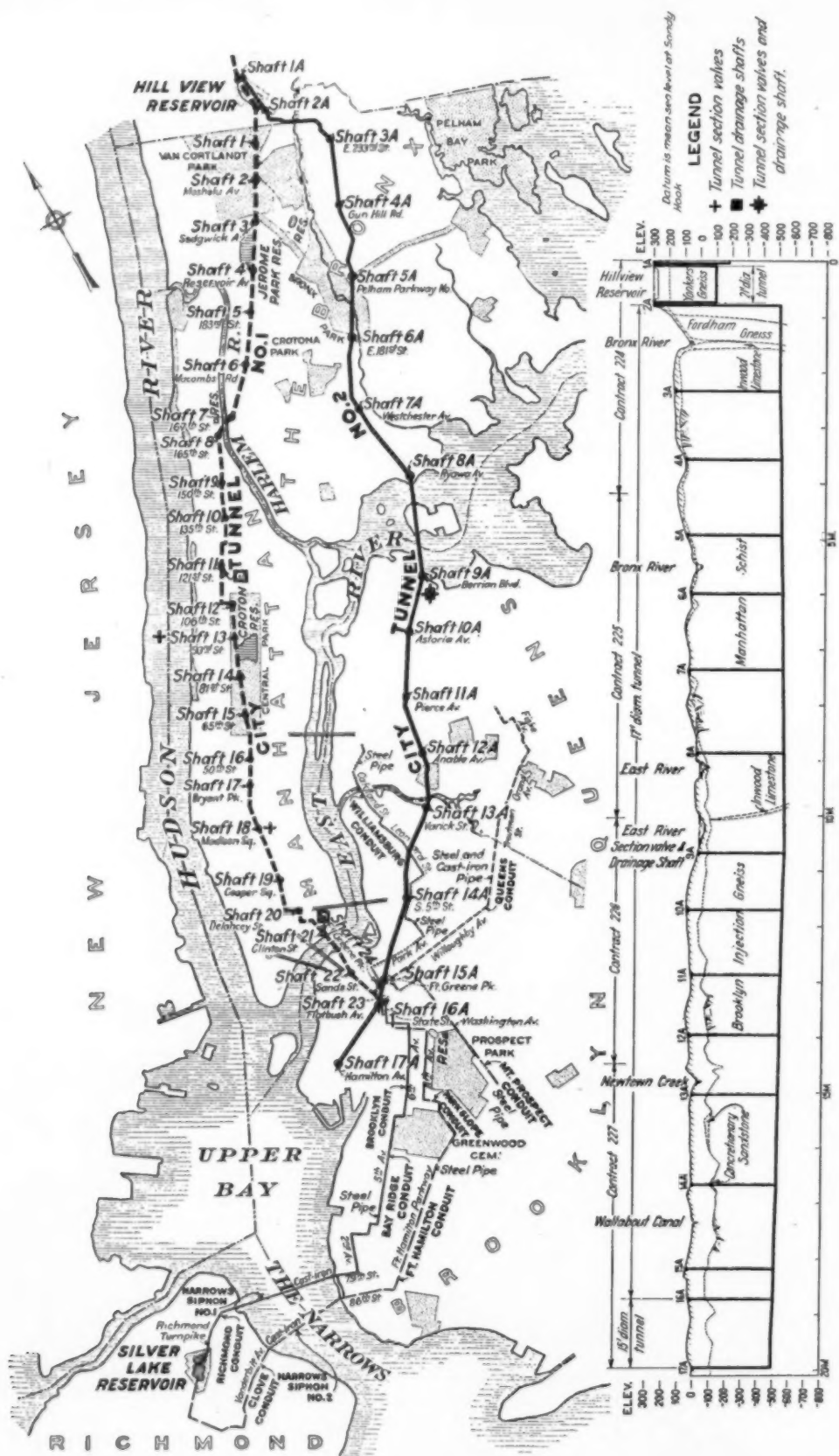
furnished by the local public service companies. This is transformed to lower voltages at the point of use. With the exception of some portable machines which are equipped with gasoline motors, all equipment is operated either by electricity or by compressed air. At the very beginning of the work, provision was made at each shaft for air compressor capacity sufficient to meet all demands for the duration of the work. Each installation consists of two electrically-driven Chicago Pneumatic or Ingersoll-Rand two-stage compressors delivering air at 100 to 125 pounds per square inch. The plant capacities vary from 3,900 to 4,400 cubic feet of free air per minute, except at Shaft 16A, from which no tunnel driving is contemplated and at Shaft 2A, where a plant was erected to serve two shafts. The capacities of these two installations are, respectively, 2,600 and 6,700 cubic feet of free air per minute.

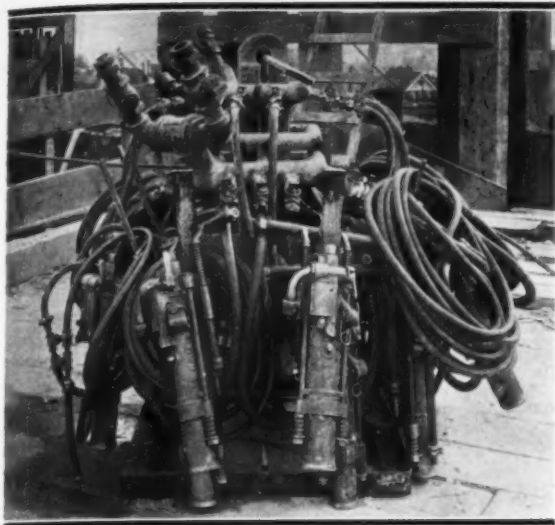
SHAFT SINKING OPERATIONS

Stiffleg derricks with 75-foot booms and with either air or electrically-operated hoisting engines were used for the early part of the shaft sinking at all points. At some shafts, head-frames supporting large mine hoists were erected for the completion of their lower portions, but many of the shafts were excavated and lined to tunnel grade by use of the derricks. That shafts as deep as 500 or 600 feet were successfully completed by this method testifies to the rigid and efficient system of



Contractor's Working Area and Surface Plant at a Shaft Site Where Working Room Is Limited. In the Left Background Is the Three-Story Steel Building Containing the Compressor Plant, Dry House, Storage Rooms and Engineer's and Contractor's Offices. In the Center Is the Headframe Surmounted by a Steel Building Housing the Hoist and Motor Generator Set, and Also the Elevated Platform for Tunnel Car Tracks and the Dumping Chutes





Home-made Drill Carrier for the Assembly of All the Shaft Drilling Equipment So That It Could Be Moved In and Out of the Shaft with the Utmost Possible Dispatch. The Frame, in Addition to Serving as a Rack for the Machines, Carries the Air and Water Manifolds with Connections to the Drills Already Made Up. The Two Main Connections for Air and Water Are Shown at the Top

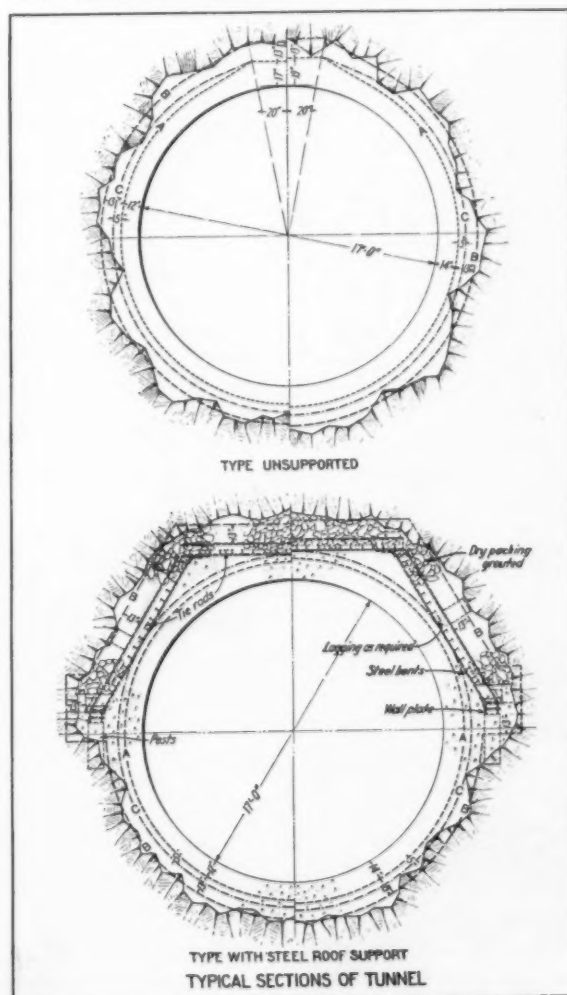
inspection that was maintained and the care used in operation.

The nine shafts in the Boroughs of Queens and Brooklyn, which are located at sites where there is from 56 to 109 feet of water-bearing sand and gravel above the bed rock, were started as caissons which were sunk under compressed air to depths which permitted tight seals in sound rock. Eight of these caissons were identical except as to height. They consisted of reinforced concrete cylinders with inside diameters of 19 feet and walls 3 feet thick. The reinforcement comprised two concentric rings of $1\frac{1}{4}$ -inch vertical rods spaced about 10 inches apart and two rows of 1-inch steel hoops spaced $10\frac{1}{2}$ inches. Reinforced concrete decks about 5 feet thick, poured monolithic with the wall, about 8 feet above the cutting edge, formed the working chambers. Four-foot steel shafts for materials and 3-foot man-ways, both equipped with air locks, gave access to the chambers. The ninth caisson, which formed the upper portion of the drainage shaft, was 28 feet in inside diameter with a 4-foot wall. The reinforcement was similar in arrangement to that of the smaller caissons, but included three rings of vertical rods instead of two and a corresponding additional number of hoops. The excavation under compressed air was in all cases carried 8 to 10 feet into the rock to satisfy the contract requirements for seal and anchorage. The working pressures reached a maximum of 42 pounds in the deeper caissons.

Five of the shafts north of the East River, four of them the double shafts at Hill View Reservoir, were in earth for depths of from 29 to 70 feet. The overburden here, however, was a glacial till, unstratified and not highly water-bearing, which permitted their excavation in open cut. Prior to the placing of the reinforced lining, these excavations were supported by Lackawanna steel sheet piling with wales and bracing of structural steel.

Familiar shaft sinking methods were used in the excavation of the shafts in rock. Drilling was done with Chicago Pneumatic No. 5 sinkers, using circular hollow steel with cross bits. Each drill was provided with a connection permitting a constant flow of water through the steel while drilling, to eliminate dust. Eight to ten drills were generally used for drilling a round and for convenience in handling were arranged on a carrier which included the air and water manifolds with all connections to the individual drills made up. On being lowered into position, only the main air and water connections were necessary before starting work. The arrangement of holes and method of shooting varied with the character of the ground and the preference of the shaft superintendents. In general, a cut and two or three breakdown rounds were drilled and the whole fired at one time, using various degrees of delayed exploders in the successive rounds. Large inflows of water encountered in several of the shafts were successfully cut off by grouting the rock through concrete blankets.

The concrete lining was carried down the shafts as the excavation progressed. Sixty to 80 feet of lining were placed at one operation, using Blaw-Knox steel forms in 5-foot units. Concrete was mixed by Ransome 1-yard paving mixers which were transported from shaft to shaft as required.



DRIVING THE HEADINGS

The headings were turned and from 200 to 300 feet of tunnel driven in each direction with the shaft sinking equipment. When the headings were sufficiently advanced to insure the safety of the tunnel driving equipment, the work was shut down and the shafts equipped for tunnel driving. Head-frames were erected at shafts which had not already been so equipped. Each head-frame was surmounted by a hoist house in which were installed a Nordberg mine hoist and a motor generator set for supplying the direct current for its operation. The hoist drums are 7 to 8 feet in diameter and about 8 feet long. They are operated by 200 kilowatt direct current G. E. motors having remote control. The balanced cages, 9 x 6 x 9 feet high, manufactured by the Connellsville Iron Works, have a maximum speed of 600 feet per minute.

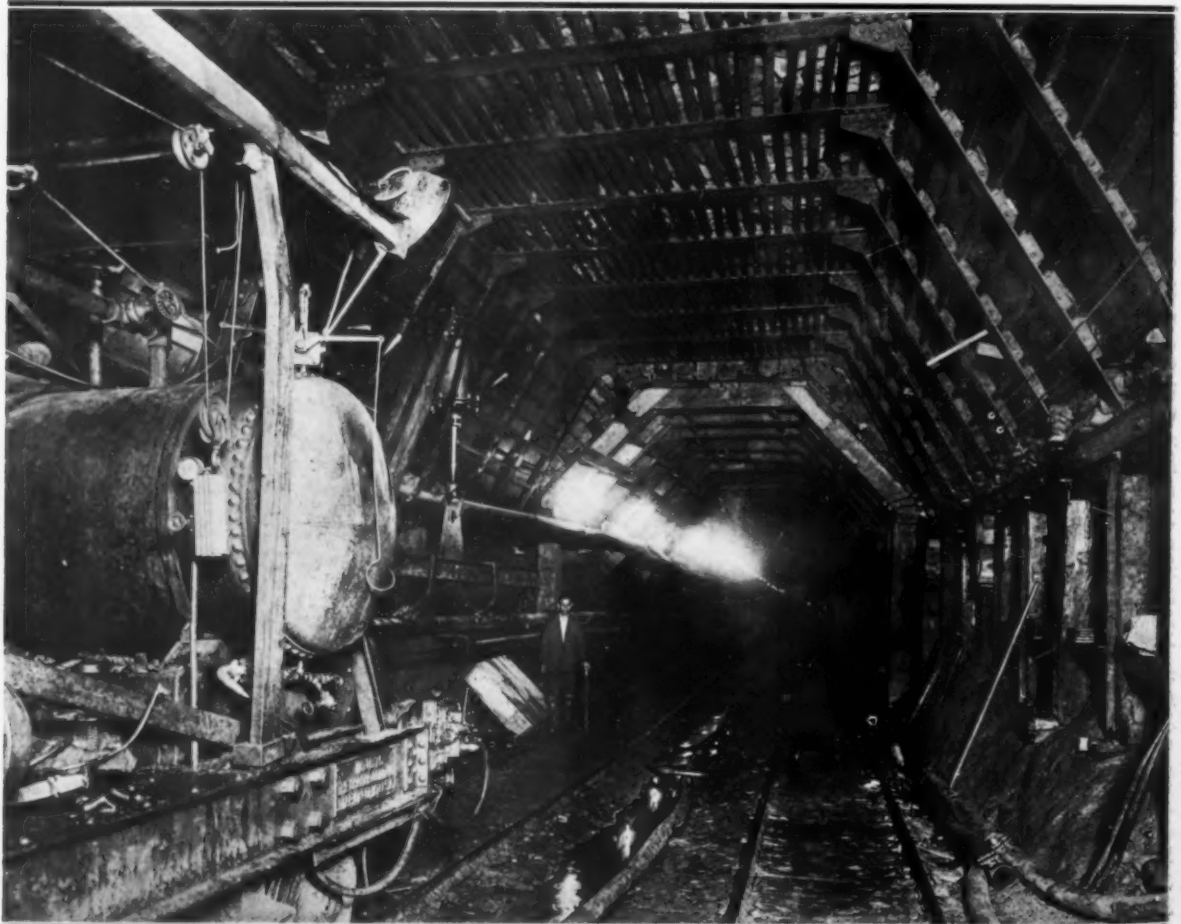
The Chicago Pneumatic No. 5 sinker drills used in the shafts have been replaced by the heavier No. 6 drifters. The equipment for one tunnel ordinarily comprises five drills mounted on three columns in the heading, and, on the bench, two drills mounted on a horizontal bar. Water to keep down the dust is used with the tunnel drilling as it was in the shafts.

MUCKING WITH AIR-OPERATED SHOVELS

Although some hand mucking in clearing the heading

and removing scattered debris from the tunnel invert is unavoidable, the removal of muck is accomplished to the greatest possible extent by mechanical means. For this work, the contractor has provided twenty-seven air-operated shovels with short booms and 1¼-yard buckets and operating on the 36-inch gage tunnel track. Twenty-two of these, furnished by the Osgood Co., are mounted on double trucks, 16 feet 2 inches between king pins. They are designed for side loading only and empty cars are brought up for loading on a track parallel to the shovel track. To avoid the frequent moving of switches, an air-operated crane is mounted on the rear of the shovel frame for picking up the cars and swinging them onto the loading track. The five remaining shovels, which were furnished by the Bucyrus-Erie Co., are mounted on single trucks and will swing the full circle within the tunnel excavation.

Muck cars are steel side dumpers made by the American Car & Foundry Co., approximately 6.7 x 5 x 3 feet deep and have a capacity when fully loaded of nearly 4 cubic yards. They are drawn back and forth through the tunnels in trains of from three to five cars by G. E. storage battery locomotives. At the top of the shaft, cars are pulled from the cages by small electrically-operated tugger hoists and the muck is dumped from an elevated platform directly into motor trucks. No storage for muck is provided at any of the shafts and a



Section of Tunnel with Supported Roof. In the Foreground Is a Permanent Support of Three-Piece Bents of Structural Steel Completely Lagged and Dry Packed. Back of This a Temporary Timber Roof Support Is Shown



An Inflow of Water into the Tunnel Amounting to Nearly 400 Gallons Per Minute. This Is the Permanent Leakage That Persisted After More Than Twice as Much Had Been Cut Off by Grouting the Rock in Advance of the Excavation

large fleet of trucks is kept in constant service to prevent delays which would result from the accumulation of loaded muck cars. The trucks are all of 5-ton capacity with steel self-dumping bodies and hold when loaded about 7 cubic yards of broken rock. In the Boroughs of Bronx and Queens the final disposition of the muck is in fill on waste land. In Brooklyn, however, it has been found necessary to tow the muck to sea for final disposal.

DRILLING AND MUCKING ALTERNATED IN TWO TUNNELS AT EACH SHAFT

The top heading and bench method is used almost universally for the tunnel excavation. The bench is kept short, only about one advance back of the heading to facilitate the handling of the muck by the shovels. A round of drilling consists of about sixty-two holes, 12 to 14 feet deep, of which forty-six are in the heading and sixteen in the bench. The bench is drilled horizontally and is fired with the cut round of the heading in order to concentrate the muck.

Drilling and mucking operations are carried on alternately in the two tunnels at each shaft. On the average, three advances a day of about 10 feet each are made at each shaft, two in one heading and one in the other. To drill a complete round of heading and bench requires from six to six and one-half hours, leaving one and one-half to two hours for the loading and shooting. On the succeeding shift, the tunnel is mucked out and the columns and drills set up for the next round of drilling.

TIMBERING

The chief obstacles to regular and consistent progress in tunnel excavation have been the occurrence of broken, shattered or disintegrated rock and large inflows of water. When either of these conditions are met, special operations are necessary which interrupt the established routine. Through shattered or blocky ground, where protection from falling rock is necessary, some form of roof support has been erected. The most common type consists of steel bents composed of a

cap and two inclined legs resting on a wall plate and spaced from 2 to 5 feet apart depending on the condition of the roof. When the rock is considerably shattered, lagging of small I-beams or channels is placed between the bents and the space between the steel and the rock filled with rock dry packing; but where danger is from the slipping of large slabs of rock, the dry packing and much of the lagging is omitted and the roof is blocked securely to the steel by timber struts. In rock which had a tendency to spall off in small pieces, a type of roof support consisting of curved pressed steel plates bolted to semi-circular steel ribs has been used with success. Timber bents are used occasionally but since these must be removed before the concrete lining is placed and their removal may be a dangerous operation, its use is avoided as far as possible. An unexpectedly large amount of roof support has been found necessary, nearly 14 per cent of the excavation to date being supported.

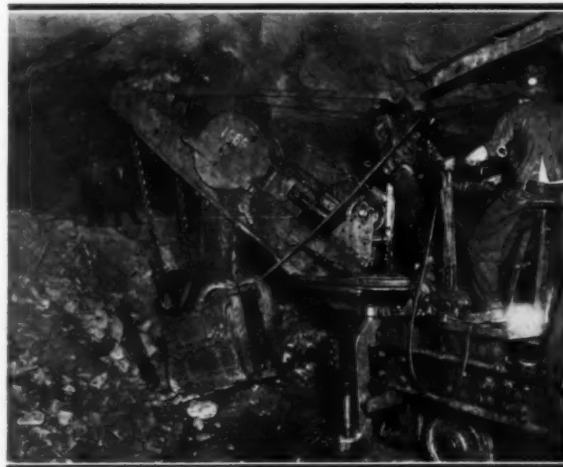
INFLOW OF UNDERGROUND WATER

Large inflows of water have been encountered at several points and when these were of sufficient magnitude to threaten the uniform progress of the work, tunnel driving was suspended and an attempt made to shut off the water by grouting the seams in the rock. Such operations have been most successful when the water was encountered beyond the face of the heading during drilling. In such cases, several additional holes were drilled in an endeavor to tap the water-bearing seam at a number of points. Gated pipes were then driven into the holes and neat cement grout forced into the rock under pressures of 300 to 500 pounds per square inch. Inward leakage in amounts varying from 50 to 100 gallons per minute and aggregating approximately 3,000 gallons per minute has been cut off in this manner. There is still entering the tunnel a total inflow of about 2,000 gallons per minute. This is made up of many separate leaks which are led to invert drains and removed through the various shafts by pumping.

PERSONNEL

City Tunnel No. 2 is being constructed for the City

(Continued on page 67)



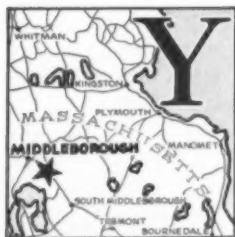
An Osgood Air-Operated Shovel Removing Muck from a Tunnel Heading

Steam Shovel

in Peat Swamp

and Machine Spreading

of Sand and Chips



YOU have heard of the man who was boasting that a certain piece of work could not be done, being interrupted by another man who told him that it had just been done. On the bituminous macadam highway project built last summer, south of Middleborough, Mass., by Frank Lanza &

Sons, on Route 28, both the contractor and the State engineers were placed in the position of the boastful individual who said it could not be done. There was a section of peat swamp that looked bad and was expected to act bad until removed by the traditional crane and clamshell. The Superintendent thought otherwise and put in a Bucyrus-Erie 41-B steam shovel with a $1\frac{1}{4}$ -yard bucket, to tackle the peat. Although the shovel went in to the top of the crawlers and several times had its fires put out by the water in the swamp, it came through with flying colors and cleaned out the peat in the swamp, so that the fill could be put in without mixing with the unstable material. Just as the *New York Sun* displays on its sporting page every night, "Don't bet on fights," so we shall be forced to display the slogan, "Don't say it can't be done."

The second remarkable feat accomplished on this job was the elimination of hand labor in the casting of the sand binder on the bottom course of coarse stone and the $\frac{3}{4}$ -inch chips on the penetrated top course. Sand and chip spreaders have been used effectively for covering large areas of highway which have been treated with tar or oil and for sanding icy pavements. The contractor reasoned that the same device might well be used to spread the sand and chips on this entire 6.25-mile macadam job. When the bottom course had been completed in one section and it was time to bind it with the sand, a Handy Sandy was attached to one of the trucks and in a few minutes time the machine and truck had done the work of about six men, much more effectively and quickly than the mere human machines could have completed it. The machine was also used to spread

*Features
of
Bituminous Macadam
Contract
Completed by
Frank Lanza & Sons
Near
Middleborough, Mass.*

the $\frac{3}{4}$ -inch stone to fill the voids after penetration, and the pea stone on the seal coat. Compare this with the three or four men you see chasing the asphalt truck as it merrily applies the asphalt penetration and recall how much touching up there has to be as the men cannot possibly cover the surface evenly with the chips. They have to go back and recast here and there while the roller patiently waits in the background until they are through before it can start rolling and interlocking the stone with the asphalt binder. With the spreader, according to the contractor, it was possible to start the roller down the strip penetrated immediately after the truck of chips which followed the asphalt truck.

SOME OF THE OTHER DETAILS

The 6.25 miles of road was laid 30 feet wide except on grades of $3\frac{1}{2}$ per cent or more where the paving was widened to 36 feet. The penetration macadam was put down 7 inches thick in two courses of $4\frac{1}{2}$ inches bottom and $2\frac{1}{2}$ inches top. The bottom course was of mixed No. 1 and No. 2 stone and the top of No. 1 stone alone.

The work included 4,400 feet of reconstruction on Wareham St. in Middleborough, and the widening and excavating of about 4 miles of old road, and the swamp work mentioned above. There was about 2 miles of relocation. There were 90,000 yards of excavation, 4,000 yards of borrow, and 16,000 yards of peat removed from the swamp.

Work was started on excavation on May 1, 1930, and the first stone went into the road on June 16.

HANDLING THE STONE

Stone was received by rail at a spur track at the Middleborough railroad station from the New Haven Trap Rock Co., New Haven, Conn. Both the large stone and the $\frac{3}{4}$ -inch chips were unloaded with a Burch belt unloader set beneath the track and delivering direct to the trucks. The unloader handled the stone at the rate of about 8 tons from the pit to the truck in 3 minutes or less. Only two men were required to handle the unloading, making a minimum of labor for this work. From 10 to 12 cars of stone were regularly unloaded and delivered to the road each day.

The gravel for the 12-inch protective subgrade course used in Massachusetts, and the sand for binding the bottom course, were secured locally. Six or seven trucks were used to haul the stone from the yard to the job and nine trucks, owned by the contractor, were used as required, for the sand and gravel. All stone hauling was done by subcontract.

The stone was spread on the base with three Burch stone spreaders running down the grade in parallel, as the contractor was not required to keep the highway open for traffic. An old and heavily travelled road paralleled the new and shorter route so that traffic was not inconvenienced. In addition to the three spreaders

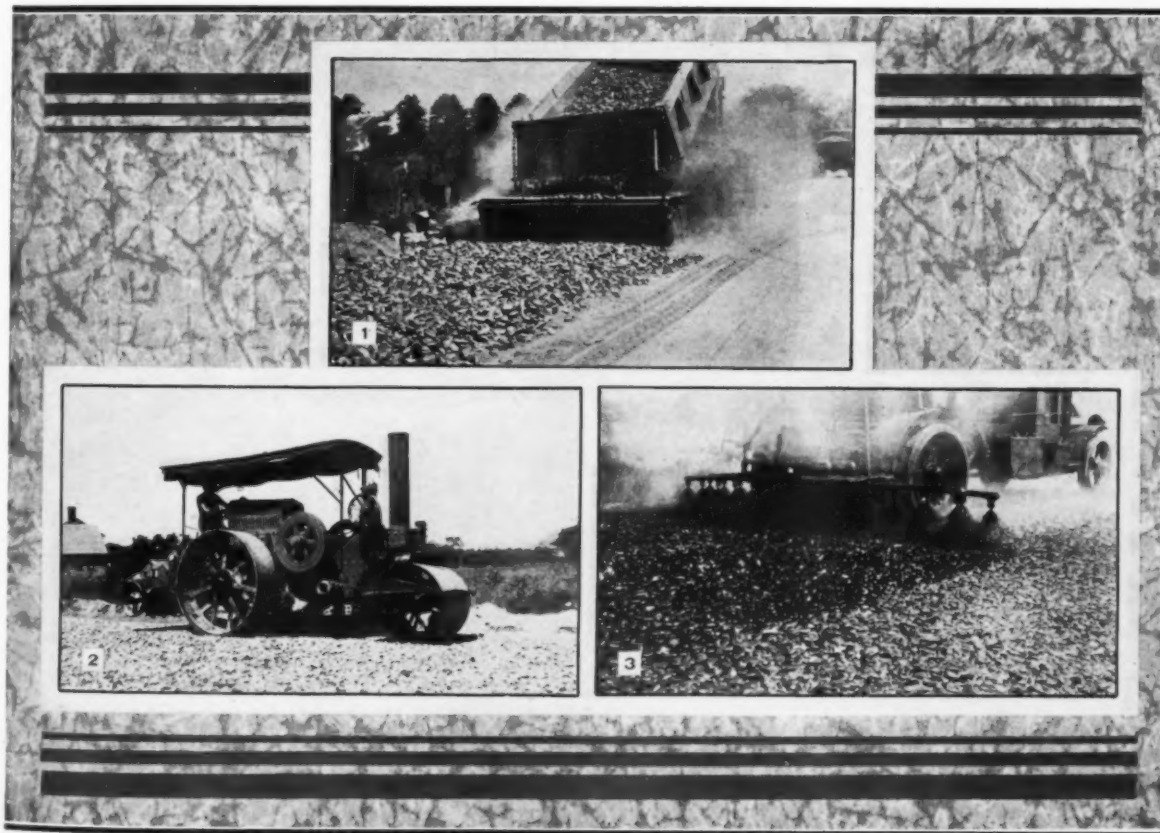
that were run in parallel, there were two others used on other parts of the work.

PREPARING THE GRADE

While it may seem that we are building this road backwards by preparing the grade, on paper, after we have told about the stone, we are giving you the highlights of the job in their most interesting order. The grade was prepared by two Caterpillar Thirty tractors with bulldozers which were run all over the job as required and proved unusually useful in pushing the fill to place and hauling out mired trucks. A Warco Road Hog one-man grader was also used to trim up the grade with the help of a labor gang of twenty-five men and two foremen. A Good Roads one-man grader was also used in another section of the work.

BASE, TOP AND ASPHALT KEPT CLOSE TOGETHER

The contractor believed that it was best to keep the base course, sand binding, top course, penetration, chips and seal with its pea stone running as close together as possible. Consequently there was scarcely a day's lap between the laying of the base and the final seal. As soon as sufficient base was laid to make a day's run with asphalt, the stone gangs were pulled back and the top put on to be ready for the asphalt. There were two gangs of men for the stone spreaders which operated in two different sections simultaneously. Of the stone



SPREADING, ROLLING AND BINDING OPERATIONS

1. One of the trio of Burch stone spreaders which ran down three parallel strips laying down the base course of stone.
2. One of the Buffalo-Springfield 12-ton gas rollers working on the top course.
3. Applying the Socony asphalt penetration with a motor truck pressure distributor

gangs of about 30 men each there were only two men in a gang who used rakes, the remainder using forks for handling the stone to fill low spots or removing excess stone.

The best day for production on the job was the day before the Fourth of July when 2,500 feet of top was placed, rolled, and penetrated, using 8 truck loads of asphalt of 982 gallons each. The strip was 15 feet wide or one-half the completed pavement width. The penetration asphalt was applied at the rate of $2\frac{1}{4}$ gallons per square yard and the seal coat $\frac{3}{8}$ gallon per square yard.

THE HEAVY EQUIPMENT

There were four Buffalo-Springfield 12-ton gas rollers, one Huber 15-ton gas roller, and one Buffalo-Springfield 13-ton steam roller used for the rolling of the base and the stone, both before and after binding and penetration.

In addition to the Bucyrus-Erie steam shovel that did such a fine job on the peat, there was also a Bucyrus-Erie gas and air crane with a 1-yard clamshell on a 45-foot boom used for a time on the peat. Three other Erie steam shovels worked on the excavation and in the sand pit. There were three utility trucks working on the job, one Chevrolet and two Ford trucks, one of which handled only gas and oil for the equipment.

WATER FOR THE SHOVELS

The contractor laid his own pipe line the entire length

of the job to insure a supply of water for the shovels. The maximum length of 2-inch pipe down at any one time was $3\frac{1}{2}$ miles. Water was supplied to the line by a Barnes triplex pump until the shovels were working close to the city line where water could be secured from the city mains, without pumping, through a meter to the 2-inch line.

LABOR WORKED TWO SHIFTS

In order to speed up the work and complete it ahead of the contract date of November 15, the contractor worked two labor shifts of 8 hours each. This speeded up the work remarkably but as the State Department of Public Works did not provide a second shift of engineers it did work some hardship on the inspectors. With the two shifts the contractor regularly put in 500 tons of stone a day on the top and base courses.

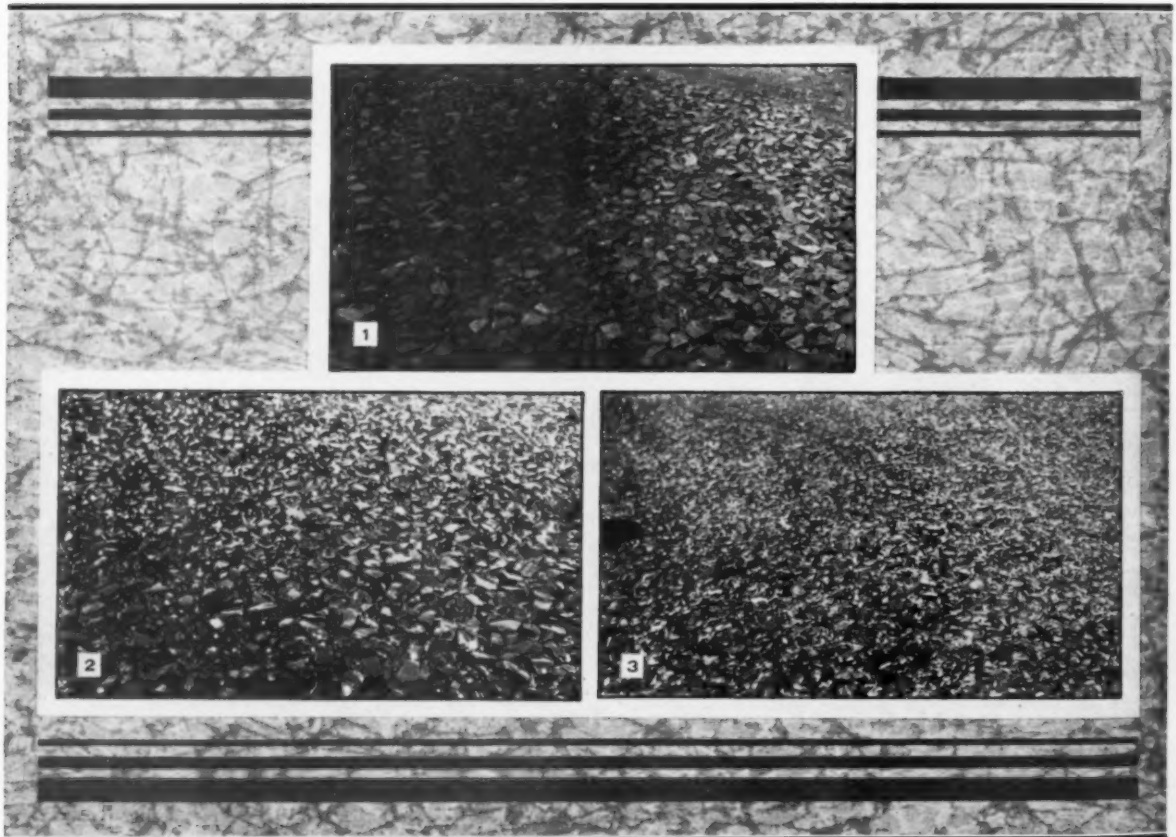
The labor was divided approximately as follows for each shift:

Stone gang	30 men
Fine grade gang	30 men
Sand and brooming gang, operators and mechanics	10 men

The remainder of the 135 men on the payroll were the drivers of the contractor's own trucks.

SOME ROCK WORK

There was only a small amount of rock work on this



PROGRESS PHOTOGRAPHS OF THE SURFACE TEXTURE ON A TYPICAL MASSACHUSETTS PENETRATION MACADAM CONTRACT

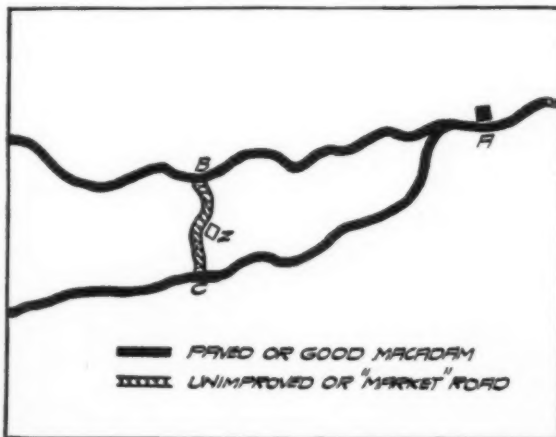
1. The top course of coarse stone rolled and before penetration. 2. The top course penetrated and before the spreading of the $\frac{3}{4}$ -inch filler stone with the Handy Sandy machine. 3. The top course complete with chips but without the seal coat

project, amounting to not more than 700 yards, but two I-R portable compressors were put into operation and the drilling handled quickly. The holes ran only from 1 to 3 feet deep and were shot with Hercules 60 per cent dynamite.

The haul for the stone and asphalt from the railroad station to the job was about 3 miles. This was dead haul but the railroad siding was located at about the middle of the project which ran on both sides of the town.

PERSONNEL

The work was done by Frank Lanza & Sons, Boston, Mass., with Albert Allison as Superintendent and G. A. Slade as Engineer and Stone Foreman. For the State Department of Public Works the work was done under the direction of H. C. Holden, Division Engineer, with F. J. Magee as Resident Engineer and J. J. Bulens as Inspector of stone operations.



A Situation Where a Portable Crusher Proved Its Worth

An Economical Method of Handling Ledge Rock for Road Surfacing

PERMANENT or semi-permanent crushed rock installations are advantageous where large quarries may be opened and where there is sufficient demand in the immediate vicinity for large quantities of various sizes of crushed stone. On many highway projects, however, the length of haul from permanent quarries is a distinct disadvantage adding to the expense and necessitating the maintenance of a very large fleet of motor trucks to insure satisfactory delivery.

Many contractors are now using portable crushers which are both hauled and driven by tractors along the road and one-man stone is delivered from small quarries or nearby ledges along the right-of-way. The accompanying map gives an interesting side light on a condition where a portable crusher unit, such as a Day crusher mounted on a Caterpillar tractor, has an advantage over a permanent or semi-permanent installation. The solid line on the map represents good macadam roads. The shaded line B-C represents a dirt road running between the two good macadam roads. A large stationary crushing plant is located at A. B and C are the intersections of the macadam and dirt road. The distance from A to B is about 11 miles and from B to C, 3 miles. In order to surface the earth road B-C by hauling rock from



A Day Portable Crusher with a Caterpillar Twenty Tractor Working in Knox County, Tenn.

A, there would be an average haul of 25 miles including the return trip. The expense would be prohibitive because of the high cost of hauling.

To move the stationary equipment from A to Z an available site for crushed stone operation would cost from \$1,500 to \$2,000. After finishing the road B-C this equipment would have to be moved again, thereby doubling the expense of moving. If the stationary equipment is erected at Z it will require opening up a large quarry to accommodate the heavy equipment.

Instead of opening the quarry or hauling the rock from A a portable crusher such as is shown in the illustration can be placed on the job. One portable compressor would be required at Z and the rock would be blasted out. A truck scatters the one-man stone along the road from Z to B and Z to C, then the portable crusher pulled by a tractor crushes the rock right on the road with the result that the dirt road is surfaced at a minimum of cost and the savings pay for the crusher and tractor which are then moved to another similar location.

Feet—Not Inches—A Correction

IN an advertisement sponsored by the Continental Motors Corporation in the February issue, an unfortunate typographical error appeared which underrated the efficiency and capacity of the Moretrench Wellpoint System operating on an interesting pumping job in the Sheepshead Bay section of Brooklyn, N. Y.

The advertisement was so worded as to say that the Moretrench pump was lowering the ground water level 18 inches, whereas, the facts are the level was reduced 18 feet.

In justice to the Moretrench Corp., Continental hastens to correct the unfortunate error, and particularly in view of the fact that this Sheepshead Bay operation is an unusually striking instance of the ability of the Moretrench System to handle a pumping job, where the success of the whole building operation depends absolutely on the pump.

There Are 122 Contractors Per 100,000 Population

THE Construction Section of the Census of Distribution received 149,798 reports from contractors in the United States in the recent count of contractors directed by the Bureau of the Census. Of this number 34,794, or 23.2 per cent reported construction work during 1929, amounting to \$25,000 and more. The construction figures also show that there were 122 contractors reporting per 100,000 population, of whom 28 reported construction of \$25,000 and more in value.

In proportion to its population, Connecticut leads all other states with 302.7 contractors reporting per 100,000 population and California ranks second with 261 per 100,000 population.

Building *a* Modern Brick Boulevard *near* Cleveland, Ohio



By
H. P. Chapman

Chief Engineer
Ohio State Department of Highways

THE section of U. S. 21 which is locally known as the Brecksville Road in the vicinity of Cleveland is one of the main traffic arteries leading into the metropolitan area. It is a section of the Cleveland-Marietta Road, one of the main trunk highways of Ohio. The average daily traffic on the section under discussion was 2,500 vehicles per day and when it is opened as a modern brick boulevard, the traffic density will undoubtedly be between 5,000 and 6,000.

The project is approximately 8 miles long, passing through the villages of Independence and Brecksville

in Cuyahoga County. The roadway, as shown by the cross section, has an overall width of 100 feet, consisting of two 20-foot paved lanes with a 26-foot parking strip between and 17-foot berms.

Due to the unusual amount of heavy industrial traffic, the base was designed for greater loads than would ordinarily be used. The base is 9 inches thick and the proportions are 1 part cement to $5\frac{1}{2}$ parts of combined aggregates. It is reinforced with standard Type A mesh which is a welded bar mat weighing approximately 54 pounds per square yard. The surface course is of 4-inch lug brick with an asphalt filler laid on $\frac{3}{4}$ -inch granulated slag cushion.

A 5 x 20-inch granite curb was used on steep grades and returns and 6 x 20-inch sandstone curb for the remainder. An earlier contract was awarded for the same project but due to some noncompliance with certain statutory requirements the contract was declared invalid after the contractor had done a considerable portion of the grading. It is an ill wind, however, that blows nobody good and the quality of the finished road is probably improved by having given the fills a chance to settle for a year.



General View of Paving Operations

PRESENT CONTRACT STARTED IN APRIL, 1930

The present contract was awarded to the Highway Construction Co., of Cleveland on December 23, 1929, on a bid of \$1,025,866.90, but was delayed by additional litigation until early spring. The first power shovel started on the project on April 14, 1930, and additional shovels, up to five, were used at various times during the construction of the project. The total yardage of excavation was 122,308.

As soon as the grading had progressed sufficiently, curb setting was started, followed by placing concrete for the base.

HANDLING OF AGGREGATES

The materials were shipped by rail to Alexander Station on the B. & O. Railroad. This station is located approximately 2 miles from the center of the project. The unloading was accomplished with two Browning locomotive cranes equipped with $1\frac{1}{2}$ -cubic yard clamshells. The cranes were operated from a separate standard gage track which paralleled the material track. In this way the contractor was able not only to take care of his unloading problems but could also handle a large amount of the shifting of cars which generally calls for a switch engine, together with the attendant delays. A Blaw-Knox proportioning plant of 150-ton capacity equipped with the necessary weighing devices was used for the batching. The material was transferred directly from the cars to the bins when-



Applying Asphalt Filler with a Squeegee Buggy

ever possible and any excess stockpiled as a reserve supply.

The total number of cars of material handled on the project, not including cement, slag for cushion or curb, was 2,418. The average agreement plan for car service was used and in handling this entire number of cars, not one cent of demurrage cost was incurred. This was made possible to a considerable extent by the excellent service rendered by the Baltimore &

Ohio Railroad.

POURING THE BASE

The old road consisted of a 16-foot brick pavement. This pavement was used as a haul road and was also kept open to traffic at all times.

The placing of concrete started on June 7. Two Multi-Foote 27-E mixers were used. They were operated from the side during most of the time, so as to keep the subgrade in as perfect condition as possible. A thorough time and delay study was made by maintaining a clerk at each mixer, whose duty it was to note each delay of over one minute.

Mixer number one averaged 34.59 batches per hour for its gross mixing time and mixer number two averaged 34.66 batches. The average daily gross efficiency of mixer number one was 86.47 per cent and for number two 83.33 per cent. The net efficiency of the first mixer was 96.22 per cent and of the second 97.92 per cent. It should also be stated for a basis of comparison, that the



The Unloading Plant Showing the Two Browning Locomotive Cranes and the Blaw-Knox Batcher

Contractors' Accounting Reports

By

J. E. Gregory, C. P. A.

Farrington, Hyland & Gregory

Certified Public Accountants

New York City

IN a preceding article the writer has explained the methods of minimizing Federal Income Taxes and incidentally State Franchise Taxes as applied to the contracting business. An article was devoted exclusively to the subject of accounting for contracts and the resultant balance sheet presentation of an entire series of business transactions.

All of these matters pertain to record keeping, one of the most important phases of any business endeavor. If one is to gage his expenses and keep them within his income, if he is to effect tangible savings through reduction in his estimates and retain these savings, if he is to be able to place his finger upon the possible future losses and curtail them, it is imperative that he utilize as his guide the monied results of his everyday business affairs. This can only be accomplished through the keeping of adequate accounting records and a constant utilization of the facts that they disclose.

This is the third of a series of twelve articles to appear monthly during 1931, covering tax, accounting and system problems as applicable to the contractor. Particular problems relative either to methods of accounting or tax matters may be directed to the offices of Farrington, Hyland & Gregory, Certified Public Accountants, Chrysler Building, New York, or to CONTRACTORS AND ENGINEERS MONTHLY, 470 Fourth Ave., New York.

In a complete sensible system of accounts the preparation of the foregoing merely means the transcribing of the totals as found upon the records, provided they are kept currently, and aside from the effect that this has upon the accounting department, it performs the more important service of keeping the executive up to the minute as regards his finances and keeps him closely in touch with his accounting department, in which connection he is generally too lax.

This daily report to him should be supplemented with remarks as to weather conditions prevailing, listing of jobs to be estimated, contracts being estimated, contracts estimated with amounts of total estimate, contracts lost with a statement of his estimate, compared with that of the high bid, the low bid and the awarded bid, and a statement of the same as regards successful bidding on his part.

THE DAILY REPORT

The old complaint that books and records are never up to date is an open admission of inefficiency or carelessness on the part of the executive.

There is no surer way of eliminating this excuse on the part of the accounting department than to demand that a report, containing pertinent facts to be taken from the books, be placed upon the executive's desk each morning covering the details of the financial affairs of the day before. A suggested form of this daily summary, which may be made more elaborate, or curtailed as to information, follows:

X. Y. Z. CONTRACTING CO. Daily Summary of Recorded Transactions to February 9, 1931

(To be taken from the Accounting Records as kept to date)

	Feb. 9, 1931	9 days to date
Bank Balances.....	\$	\$
Requisitions Billed.....	\$	\$
Collections Received.....	\$	\$
Accounts Receivable—Due on Requisition.....	\$	\$
New Contracts Receivable Signed.....	\$	\$
New Subcontracts Awarded.....	\$	\$
Material Bills Credited.....	\$	\$
Subcontracts Requisitioned.....	\$	\$
Material Creditors Paid.....	\$	\$
Subcontractors Paid.....	\$	\$
Balance due Material Creditors.....	\$	\$
Balance due Subcontractors.....	\$	\$
Cash Paid.....	\$	\$
Cost of Jobs in Progress.....	\$	\$
Signed JOHN DOE—Accountant		

THE CONTRACTORS' ACCOUNTING REPORT

The supplementary data in proof of the accompanying balance sheet will be tendered during the course of explaining the exhibits and schedules made a matter of reference.

Each month, or at least each three months, a report upon the contractor's business should be tendered in full form. This report should comprise:

- A—Balance Sheet
- B—Surplus Statement or Capital Account
- C—Income and Profit and Loss
- No. 1—Contracts and Jobs Status

In this article discussions of B and C are purposely omitted as the principal feature is the presentation of the balance sheet and supporting schedule No. 1.

The writer criticizes the form of Balance Sheet adopted by the Joint Conference on Construction in 1925. It is evident that provision has not been made to cover all contractual relations as outlined in the following, taken from the writer's files at random, as representative of what a proper balance sheet should reveal:

X. Y. Z. BUILDERS, INC.
Balance Sheet—December 31, 1930

ASSETS AND DEFERRED CHARGES	
Cash—On Hand and in Banks—Counted, Verified & Reconciled	\$201,312.20
Accounts Receivable—Due on Requisition—Schedule No. 1	121,709.42
Retainage Withheld on Contracts to Date—Schedule No. 1	99,142.95
Inventory of Working Materials—From Yard Foreman	22,305.57
Accounts, Loans and Notes Receivable—Other	6,257.43
Cost of Jobs in Progress—Schedule No. 1	302,730.74
Contracts Receivable—Balances Unrequisitioned—Schedule No. 1	1,018,980.00
Job Costs Subcontracted—Balances Unrequisitioned—(Contra)	236,363.25
Real Estate Holdings	443,216.04
Investments in Bonds and Stock	9,600.00
Equipment, Trucks, Business Cars and Fixtures	40,184.09
Deferred Charges—Interest, Insurance, Organization Expense	5,361.36
Total Assets and Deferred Charges	\$2,477,223.05
LIABILITIES, RESERVES AND CAPITAL	
Notes Payable—Banks—Confirmed	\$30,000.00
Accounts Payable—Administrative Expense	3,994.49
Accounts Payable—Material Creditors—Schedule No. 1	63,875.30
Subcontracts Payable—Due on Requisition—Schedule No. 1	50,954.10
Accounts, Loans and Notes Payable—Other	34,737.58
Reserve Covering Uncompleted Contracts—Schedule No. 1	1,484,366.42
Subcontracts Payable—Balances Unrequisitioned—(Contra)	236,363.25
Mortgages Payable—Real Estate	274,750.00
Reserves for Depreciation	12,904.00
Deferred Credits—Unearned Items of Income	140.00
Capital Stock Authorized, Issued and Outstanding	100,000.00
Surplus	185,137.91
Total Liabilities, Reserves and Capital	\$2,477,223.05

In support of the above presentation, Schedule No. 1 is decidedly the most important. This particular schedule is designed to show by jobs or contracts the following information: Total Contracts and Extras Taken into Income, Unrequisitioned Balances, Requisitioned to Date, Retainage Withheld, Cash Received, Due on Requisition, Direct Job Costs—comprising Labor, Materials, Subcontracts, Equipment, Other Costs, Gross Cost of Completed Jobs, Gross Cost of Jobs in Progress, Gross Profit on Completed Jobs, Overhead Applied to Completed Jobs, Overhead Applied to Jobs in Progress, Total Cost of Jobs in Progress, Net Profit on Completed Jobs, Unpaid Accounts Payable, Unpaid Subcontracts Payable.

Prepared in running form this scheduled presentation is condensed as follows:

A study of Schedule No. 1 below reveals the extent to which records may be made to indicate business facts. For convenience only two jobs have been detailed,

whereas in actual procedure all jobs are given full indication and the use of the "Other Jobs" column is eliminated.

EDITOR'S NOTE: As the accounting article in the May issue will refer to the tables included in this article, we advise our readers who are following this series to keep this article for reference.

Huge Grading Job on Arkansas Cross State Highway

THE last link on Arkansas Route 2, which runs through the southernmost tier of counties from Texarkana across to Greenville, Mississippi, is now under construction between Strong, Union County and Crossett, Ashley County. The largest grading job on this section and one of the largest jobs ever let in Arkansas, according to *Arkansas Highways*, is Job 7120, 4 miles long across the bottom on the west side of the Ouachita River.

This embankment is 30 feet wide on top, 18 to 26 feet high and from 102 to 134 feet wide on the base. The contract calls for 214 acres of clearing and 1,286,371 cubic yards of dirt. The contract allowed one year from April 1, 1930, for completion. Because the water had not receded from the bottom, the contractors, Horton-Price Construction Co., were unable to start work until July. In spite of this, however, practically 75 per cent of the work is now complete.

The Monighan walking dragline used on this job is next to the largest machine of this type ever built. The cab is 30 by 45 feet, larger than the average 6-room house, and the interior resembles a large power plant, and has a completely equipped shop in one corner. A 4-cylinder Fairbanks-Morse 240-horsepower diesel engine direct-connected to a 100-horsepower generator and belt-connected to the main shaft from which the 3-cable drums and walking rollers are driven provides all of the power for this part of the equipment. The swinging engine is driven by a 100-horsepower motor and a large air compressor is belted to the main drive. A 40-horsepower Waukesha gas engine with an auxiliary air compressor and electric generator and an independent self-contained 2,000-watt generator complete the power equipment on this dragline.

X. Y. Z. BUILDERS, INC.

SCHEDULE No 1—CONTRACTS AND JOBS STATUS—DECEMBER 31, 1930

Item	R. J. H. S.	M. J. H. S.	Other Jobs	Totals
Completed Contracts (Taken into Income)			\$577,887.40	\$577,887.40
Contracts in Progress—Totals and Extras	\$525,576.42	\$958,790.00	None	1,484,366.42
Open Accounts Prior Periods			1,588.50	1,588.50
Total Contracts, Balances and Extras	\$525,576.42	\$958,790.00	\$579,475.90	\$2,063,842.32
Unrequisitioned Balances	213,493.00	805,037.00	None	1,018,530.00
Requisitioned to Date	\$311,633.42	\$153,753.00	\$579,475.90	\$1,044,859.32
Retainage Withheld to Date	40,080.00	23,062.95	None	63,142.95
To be Received	\$265,553.42	\$130,690.05	\$579,475.90	\$975,719.37
Cash Received to Date	222,422.92	73,655.05	557,871.98	\$853,949.95
Due on Requisition	\$43,130.50	\$57,035.00	\$21,603.92	\$121,769.42
Direct Job Costs:				
Labor	\$77,227.72	\$10,445.44	\$125,027.23	\$212,699.39
Materials	65,697.74	20,234.46	123,004.24	208,936.44
Subcontracts	60,860.25	17,302.26	283,262.04	361,224.55
Other	1,764.83	20,637.24	11,882.94	34,285.01
Gross Cost of Jobs in Progress	\$205,350.54	\$68,619.40	\$348.00	\$274,217.94
Gross Cost—Completed Jobs			542,927.45	542,927.45
Gross Profit on Completed Jobs			\$34,959.95	
Overhead Applied to Jobs in Progress	21,352.06	7,134.95	\$25.79	28,512.80
Overhead Applied to Completed Jobs			56,452.82	56,452.82
Total Cost of Jobs in Progress	\$226,702.60	\$75,754.35	\$373.79	\$302,730.74
Total Cost of Completed Jobs			599,350.27	599,350.27
Net Loss on Completed Jobs			\$21,492.87	
Unpaid Accounts Payable	\$34,352.09	\$14,524.12	\$14,999.09	\$63,875.30
Unpaid Subcontracts Payable	21,198.75		29,755.35	50,954.10
Total Indebtedness on Jobs	\$55,550.84	\$14,524.12	\$44,754.44	\$114,829.40

Well-Point Drainage

and

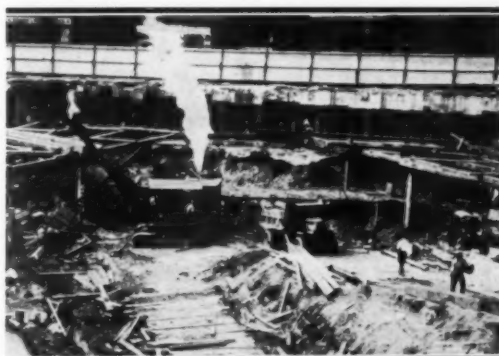
30-Hour Continuous Pour

of

Concrete

on

Building



Excavation Under Way Showing a Portion of the Earth Ramp at the Right

By

S. I. Foster

*H. J. Deutschbein Co., Inc.
New York*

Foundation Job

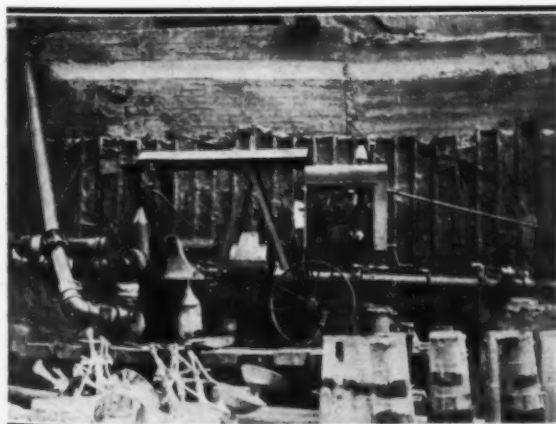
THE New York Telephone Co. is now constructing the westerly half of a 28-story addition to its building at 24 Walker Street, New York City. The addition, trapezoidal in plan, occupies the area between the present building on the east, the new Sixth Avenue subway on the west, and fronts 50 feet on Walker Street and 150 feet on Lispenard Street, with a

depth, perpendicular to the streets, of 196 feet. The foundations of the present structure, built in 1914, are large concrete caissons, sunk by pneumatic process to coarse gravel stratum, approximately 2 feet below the subgrade of the new building. The soil pressures under the old foundations were estimated to be from 8 to 14 tons per square foot. The subway foundation on the westerly side of the lot is at approximately the subgrade levels of the new building.

The foundation for the new building consists of a reinforced concrete mat 6 to 7 feet thick, bearing on a stratum of coarse sand which is underlaid by strata of gravel. The underside of the mat is about 35 feet below the street and 20 feet below the ground-water table.

WELL-POINT DRAINAGE SYSTEM INSTALLED

After general excavation had reached ground water at about elevation 14 feet below curb, a well-point system was installed. Specifications required the water to be lowered to, and held at, a depth of 2 feet below final excavation grade. One hundred and twenty points were driven on 6-foot centers around the perimeter of the lot, to a depth of about 5 feet below the desired level. The points were connected by swing couplings to a 6-inch header, and three Moore gasoline-driven centrifugal pumps, especially designed for this class of service, were



The Moretrench Pump on the Well-Point Drainage System



Excavating the Earth Ramp and Placing Reinforcing in the Foundation Mat

cut in at approximately equal distances on the header. The discharge was through three 6-inch lines to a catch-basin on the street. The quantity of water delivered by the pumps was measured by Pitot tubes and was found to be 900 gallons per minute when the water had been lowered to the required level. The quantity was considerably in excess of this amount when pumping was commenced. Due to the heavy gravel which underlaid the sand at the subgrade, difficulty was experienced in sinking the well-points to the desired level. Various jetting methods were tried without success in penetrating the gravel. Finally, a 6-inch steel pipe of the required length, fitted with a conical cast-iron point, was driven at the location of each well-point. After the well-point had been inserted in the pipe, the pipe was withdrawn, leaving the cast-iron point and the well-point in the ground. A light steam hammer, hanging from the crane boom, was used for driving the pipe, and pulling was accomplished by the crane with a two-part pulling line. This method of installing the well-points also eliminated the danger of loosening ground by jetting in proximity to the present building foundations and the subway foundation. The level of the ground water was closely controlled by cutting out a varying number of the well-points.

UNDERPINNING EXISTING BUILDING

Careful levels were taken daily or oftener on the columns of the existing building and slight settlement was recorded as the water level was lowered by the well-points. Though this settlement was not alarming, it was decided to underpin the four northerly columns adjoining the new work, as the equipment of the existing building includes automatic exchanges which are highly sensitive to any disturbance.

The underpinning was accomplished by jacking four

12-inch Bethlehem H-beam sections under the ends of the cantilevers on which the columns rested. The H-beam sections were jacketed in 7 and 12-foot lengths by 200-ton Watson-Stillman hydraulic jacks. The ends of the sections were milled and were spliced together by heavy butt-plates, electrically welded. The piles were jacked into the coarse gravel stratum until a resistance of 200 tons was obtained. After the piles were wedged up to the under side of the cantilevers, no further settlement was noted on these columns.

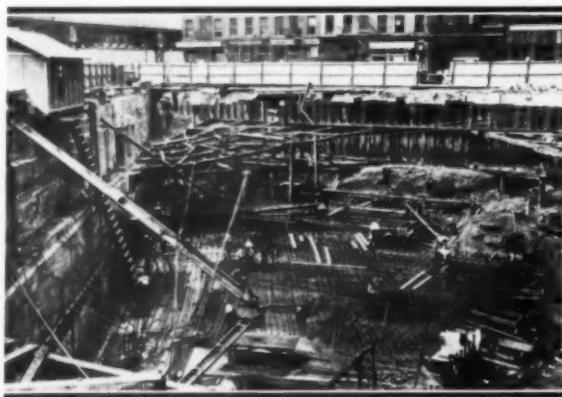
Larsen arched web steel sheeting, with steel wales and timber spur bracing, supported the banks along Walker and Lispenard Streets.

CONCRETE MAT FOUNDATION POURED IN SECTIONS

Because of the small difference in elevation of the subgrade of the new foundation and the bottom of the adjoining old foundations, and because of the rather high soil pressures under the latter, it was required that the excavation and concrete mat construction, below elevation 82 feet, 6 inches, which is 10 feet above subgrade, should be done in sections, so arranged as to prevent unloading complete areas, thereby preventing any heaving of the ground and a possible settlement of the existing building. It was also provided that all excavation should be in the dry, the lowest excavation to be always at least 2 feet above water level.

The first and largest section to be done occupied the middle portion of the lot adjoining the subway structure. This section was excavated by an Erie steam shovel to within 2 feet of the subgrade, the last 2 feet being loaded into buckets by hand. A dirt ramp provided a runway for the trucks. A

4-inch concrete working mat was laid over the subgrade, the concrete aggregate being gravel taken from the final trimming excavation.



Placing Reinforcing and Showing the Chuting System and Supporting Cables at the Left



The Wood Ramp, at the Left, and the Earth Ramp Removed, August, 1930

As fast as the working mat was completed, reinforcing was placed and bulkheads were built. All construction joints were provided with shear rods, concrete keys, and a copper water-stop. Two 1-cubic yard paving mixers, one a Koehring and the other a Ransome 27-E, had been installed at street level on the westerly side of the lot, each mixer discharging into chutes supported by rope tackle between two cables stretched across the lot, allowing lateral travel of the chutes from cable to cable. This, together with a full circle rotation of the last section of the chute, permitted the concrete to be delivered to any desired point with a minimum of delay for adjusting the chutes.

ONE 30-HOUR CONTINUOUS POUR

The operation of pouring the first section of the foundation mat, comprising about 2,000 cubic yards of concrete, was completed in thirty hours elapsed time with the two mixers working simultaneously. As there was not space at the site for any storage of concrete materials, the delivery of cement and aggregates was carefully planned in advance. Barges carrying the required amount were delivered at the unloading pier of a commercial yard about $\frac{3}{4}$ -mile away before the start of the pour, the aggregates being delivered by a fleet of five trucks to the mixers in measured batches as required, from a commercial yard.

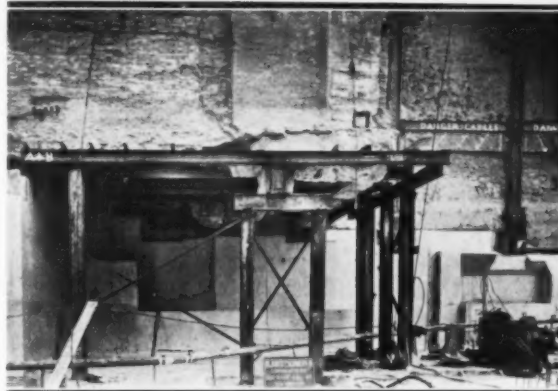
The method of placing the concrete was as follows: chutes were directed to one corner of the section and a berm built up, the top of which was at final grade. The concrete flowed from the berm on a slope of 1 on 10. The chutes were gradually moved to extend to the top of the berm and to always keep the concrete green on the slope. This was continued until the section was complete. A 4 to 6-inch slump was allowed.

After this section of the mat was completed, a timber ramp, to replace the dirt ramp, was built from the top of the mat to Lispenard Street, and an Erie shovel rigged as a crane with clamshell bucket, working on the completed mat, together with some hand work, completed the excavation of the five remaining sections. These sections were excavated and concreted one by one in separated locations, in order to avoid unloading the soil over large areas. Each of these sections contained from 350 to 500 cubic yards. The concrete was distributed by the chuting system described above.

STRUCTURE BUILT OVER THE TELEPHONE CABLE VAULT

A two-story structure used as a telephone cable vault extended from the existing building on to the lot of the new building. This vault was about 40 x 65 feet in plan and its foundations were about 18 feet above subgrade of the new building. As it was deemed impracticable to move the large number of cables housed in this vault until a new vault was ready to receive them, it was planned to construct the new building around and over this vault and to build the new foundation mat underneath it. It was necessary, therefore, to support the old cable vault on a framing of steel beams and girders, before excavation could be started under the vault.

The girders and beams were partly supported on 10-foot H-beam sections driven to rock and partly on the foundations of the existing building. The wall and



Steel Underpinning Supporting a Two-Story Extension Containing the Transatlantic Radio Land Cables. The 10-Foot H-Beams Were Driven to Rock

floor loads were transferred to the runners and girders by short needle beams. The system was placed so as not to interfere with the installation of the permanent steel of the new structure. As the excavation was carried down under the vault the H-beam piles were X-braced by 3 x 3 x $\frac{1}{4}$ -inch angles, all connections being electrically welded.

EXTERIOR WALL CONSTRUCTION

The exterior walls of the 28-story building rest on the foundation mat. They are 4 feet in thickness and self-sustaining up to the first basement floor, above which they are 2 feet and braced by the floor system. Both wood and steel forms were used for pouring this wall. By moving the mixers most of the concrete in the walls was placed by chutes. At inaccessible locations buggies were used.

PERSONNEL

Voorhees, Gmelin & Walker, 101 Park Avenue, New York City, are the architects; Moran and Proctor, 342 Madison Avenue, New York City, the consulting engineers; Marc Eidlitz & Son, Inc., Pershing Square Building, New York City, the general contractors; and H. J. Deutschbein Co., Inc., 122 East 42nd Street, New York City, the foundation contractors. The Moretrench Corp., Rockaway, N. J., furnished the well-point system. The steel wall forms were furnished and placed by Liomin & Wales Co., New York, N. Y.

Driving the Longest Continuous Rock Tunnel in the World

(Continued from page 55)

of New York under the supervision of the Board of Water Supply; George J. Gillespie, Philip F. Donohue, William F. Delaney, Commissioners; Thaddeus Merri-man, Chief Engineer; Walter E. Spear, Department Engineer, Headquarters; and Charles M. Clark, Department Engineer, City Aqueduct Department, in direct charge of the tunnel construction. The contractor is Patrick McGovern, Inc., Patrick McGovern, President; J. S. Macdonald, Chief Engineer; C. H. Harrington, Construction Engineer, Patrick Porter, General Superintendent and Peter V. Connolly in charge of construction at the southerly end.

How the Other Fellow Did It

Construction Briefs

Drop Inlets to Culverts Built Progressively

79. On a Florida highway project along the Gulf the erosion from the hills near a long fill was such that the culverts were quickly filled up and blocked with eroded material. To overcome this, drop inlets were built at the foot of the hill and connected with the culverts under the fill. A 3 x 3-foot concrete riser was built in 4-foot lifts to form a drain for water and silt washed down from the slopes. The riser is similar to those used in reclaiming farmlands and permits the silt to settle out and build up the low spots. The riser was maintained with about 2 to 3 feet of freeboard, and as soon as the silt rose to within 2 feet of the top another 4-foot lift was added. 19.10.76

Material Handling for Large Concrete Spillway

80. To furnish the concrete for the Bonne Carre spillway, 7,700 feet long, on the left bank of the Mississippi about 30 miles above New Orleans, a well planned central mixing plant was erected at a central point with reference to the longitudinal axis of the weir or spillway. Two 1-yard mixers equipped with inundators were installed. Cement was lifted to the storage bins by compressed air and fed to the hopper through a weighing device which closely checks the actual cement consumption and offers a practical gage for the theoretical cement factor. A 3-inch slump was desirable from the standpoint of workability, but was maintained with difficulty, due apparently to variation in the size of aggregate. It was necessary also keep a constant check on the moisture content of the aggregate particularly after a rain, and to compensate for extra moisture with additional cement to maintain the proper ratio. Mixing was continued for at least 1½ minutes with 12 revolutions of the mixer drum traveling at a rate of 200 feet per minute. The finished concrete was then dropped into buckets, which were conveyed by motor trucks to the forms for pouring.

Transportation during the winter months and prior to the construction of the fore apron, was hindered by soft roads, necessitating the use of mats. This difficulty was overcome, however, and for several months it was possible to operate at the full capacity of 56 yards per hour, using a fleet of 4½-ton trucks each carrying two 1-yard buckets hauling the concrete to the site of the work, where it was lifted and poured by a crawler crane. JACI 27.11.259

Methods to Prevent Freezing in Pouring Reinforced Concrete Retaining Walls 40 Feet High in Winter

81. In the construction of a 125,000-ton rock storage bin which involved the pouring of reinforced concrete retaining walls 40 feet high on the cantilever type, the contractor was faced with the difficult problem of preventing freezing of the wet concrete. This was overcome by setting a 20-horsepower vertical type steam boiler on a log sled and by means of a hand winch drawing it along as the work progressed. After the forms were in place for the footing, steam hose lines were run from the boiler into the forms and the ice or snow thawed. Then the reinforcing bars were set in place and the framework that supported the bars was covered with winter weather canvases. Salamanders were then placed at the bottom of the footing and kept under full fire so that concrete could be

poured the following day. By opening up the canvases at one end of the footing the motor trucks transporting the concrete were able to back under the tent of canvas and dump their loads. After the footing was poured the salamanders were equally distributed over the top of the footing and the end canvases let down.

For the wall pours the steel gantries were completed enclosed with canvases securely fastened and at the wall bottom as many as 30 salamanders were kept hot inside the winter weather canvases. Of 15,000 cubic yards of concrete in these walls and footings, 12,000 cubic yards were poured during the winter months and required this protection.

The procedure on the wall pours was as follows: on the first day the concrete was poured in one section. On the second day the forms were stripped and set up in the next section and on the third day an additional section was poured. This procedure permitted five wall pours per week as there were movable forms for both side walls. To facilitate the spouting of concrete from the concrete tower to the wall a 1¼-inch steam pipe was carried from the boiler up a leg of the concrete tower to the concrete hopper at the top of the tower. At this point a T was placed on the steam line with a valve on each side of the T. One branch of the steam line was used to allow steam to pass into the concrete hopper. The other branch was made up of the length of steam hose on the end of which an 8-foot length of pipe was joined. When the concrete clogged in the spout, the flexible steam line was used to good advantage in breaking it loose.

At the central mixing plant a 40-horsepower steam boiler supplied steam to coils in the sand and gravel hopper and batch water barrel. Steam jets were kept in place in the sand and gravel storage bins. A complete housing was built over the sand and gravel siding to enclose four cars and salamanders were set at track level along each side of the cars in this housing to keep the sand and gravel from freezing. A 1¼-inch steam hose with perforated pipe at the end was used to thaw sand and gravel that had frozen in transit. 19.11.61

Central Mixing Plant Served by Bucket Elevator

82. A building contractor in New Orleans, after giving considerable thought to the question of haul, the advantages of numerous small mixers scattered about the job and other conditions, decided to construct a central mixing plant about 3 blocks from the concrete structure under erection. On a spur track available near the building a temporary, but well thought-out, plant was erected. Sand and gravel were received by rail in gondola cars which were unloaded at night or at times when the plant was not running to stockpiles at either side of the batching plant and bins. The stockpiles were well boarded high enough to permit the materials to run by gravity to small pits, from which it was continuously removed by a bucket elevator each for the sand and gravel. A crane with ¾-yard clamshell was used for unloading the aggregate. The cement was received in box cars and unloaded by wheelbarrows to the cement storage house, which was two stories high. To elevate the cement as needed for the batchers, the skip of an old concrete mixer was used as an elevator and raised vertically. Three 1-yard trucks were used to haul the batches from the central mixing plant to the yard, where the concrete was dumped into the opposite section of the building. The best day's pour was 349 yards of concrete, mixed, delivered and poured into the forms. 19.10.85



The Construction Camp of A. E. Jupp Construction Co., Near Omemee

By
R. M. Smith

*Deputy Minister of Highways
Toronto, Ontario*

WITH an excellent Government-owned gravel pit strategically located at the center of the job, the A. E. Jupp Construction Co., Ltd., of Toronto, entered on a 6-mile concrete paving contract on No. 7 King's Highway west of Omemee this past summer, on a section of what will eventually be a 500-mile highway from Sarnia to Ottawa.

THE GRAVEL PIT OPERATIONS

In addition to providing a high class of gravel, the Ontario Department of Highways, following its usual practice, also furnished the cement, but the contractor had to supply his own aggregates. The pit was about three acres in extent and had a probable depth of 60 feet. Only a 25-foot face was used. The material was free of silt, clay or other deleterious material. The

A Well-Organized Ontario Concrete Paving Job

overburden consisted of practically only grass. This was removed by picks and forks. The natural grading of the gravel was almost perfect. Throughout the whole paving operation the quality of sand and coarse aggregate was perfect.

Water was also conveniently obtainable, being pumped from springs about half a mile away from the plant. By "ponding" the water from these small springs and returning the water from the washing plant to the pond, the water supply remained quite sufficient, despite the dry season. The pond was about three acres in extent, and due to the heavy underbrush in it, purification of the dirty returned water by sedimentation was successful. The dirty water entered the west side of the pond while the pumps were located on the east.

A $\frac{3}{4}$ -yard Erie shovel was used in the pit. Two heavy-duty 5-ton trucks hauled the gravel from the shovel to the washing and screening plant. The trucks



The Crushing and Washing Plant on Highway No. 7

dumped onto an inclined screen with bars spaced $1\frac{1}{2}$ inches apart. Thus the larger stone was separated from the finer. The large stone dropped directly into an 11 x 22-inch Acme crusher which was operated by a 45-horsepower MacDonald steam tractor. The jaws of the crusher were set at 2 inches spacing. The crushed stone was elevated by a chain-bucket elevator and the material dropped directly onto the inclined screen. Any large flat slabs of stone that had passed through the crusher were caught by the screen and returned to the crusher. The fine material that passed through the coarse screen into a hopper, was fed by hand-operated gate directly onto a belt-bucket conveyor. This conveyor deposited the material into the revolving, inclined cylindrical washing and screening drum.

At the point of charging, water was also admitted. This was supplied by a C H & E 4-inch centrifugal pump. The drum was 42 inches in diameter and about 18 feet long. It was situated directly above the sand box and only 8 feet above the ground. Coarse aggregate was deposited directly onto a 60-foot Barber-Greene belt conveyor. The oversize, all stone that did not pass through the 3-inch openings of the screen, was deposited directly onto an endless belt returning it to the crusher.

The sand box used was a Dominion Road Champion. It was placed on the ground. The sand was deposited onto a 60-foot Barber-Greene conveyor.

In order to insure aggregate free of the usual clay deposit, due to the drying of the dirty water on the aggregate, a perforated 2-inch pipe was led into the center of the washing drum. It was perforated with a row of one-eighth holes, 4 inches apart. The water was supplied by a 2-inch steam duplex pump. This water under heavy pressure washed the stone perfectly.

The power for the washing screen and sand box was supplied by a Fordson gasoline tractor. The plant required two men besides the operators.

The output was about 40 cubic yards of coarse aggregate and 20 cubic yards of fine aggregate per hour.

STOCKPILES REQUIRED

Because of a change in the 1929 specifications the contractor was obliged to stockpile his aggregates, but the pit being located at a good elevation, he was fortunate in that he was able to establish his plant at a lower elevation, permitting much of the material to be handled by gravity.

Stockpiling also prevented use of the bins for direct discharge to trucks, and the consequence was that the plant was lowered considerably, with a decrease in costs to some extent.

From the sand and the coarse aggregate discharges, material was taken to the stockpile by belt conveyors. Stockpiling was facilitated by the use of the Barber-Greene conveyors. These conveyors are designed to move in the arc of a circle. Thus the material washed one day was used the following day. Each day these conveyors were swung back and forth in order to give the desired results. Stockpiling was certainly successful in producing concrete much more uniform in consistency.

BATCHING METHODS

From the stockpile the material was elevated to sep-

arate bins for discharge into the trucks. A $\frac{3}{4}$ -yard Koehring gasoline crane was used to elevate the aggregates into the bins. Johnson weight-volumetric fine and coarse aggregate batchers were used. These bins were so arranged that the coarse aggregate was placed in the bottom of the truck, the cement was then charged over this material and the sand placed on top. The advantage in this was that it prevented the cement being blown away during conveyance to the job. It also enabled the contractor to keep an accurate check on the quantity of cement used, and saved him considerable money because of a minimum of damage to the cement sacks. The cement was handled entirely by hand. Trucks hauled it from the railway cars to a platform situated between the stone and sand bins. Four men placed the required amount of cement on the trucks.

As mentioned previously the department supplies the cement but the contractor is expected to pay for all sacks that are damaged or unaccounted for, the price being 20 cents per sack. On this 6-mile job 120,000 sacks of cement were used, representing in the value of sacks, the sum of \$24,000.

HAULING

Conveying the material to the job presented no difficulties as subsoil conditions were good, owing to their gravelly nature, and the contractor invariably had a good surface to work over. Neither did the prepared subgrade cut up under the truck traffic. White trucks were used, each carrying three batches.

PREPARING THE SUBGRADE

The subgrade was prepared by scarifying with a Waterous 10-ton roller. The grading was done by a Number 12 Adams leaning wheel grader hauled by a Monarch-50 gasoline tractor.

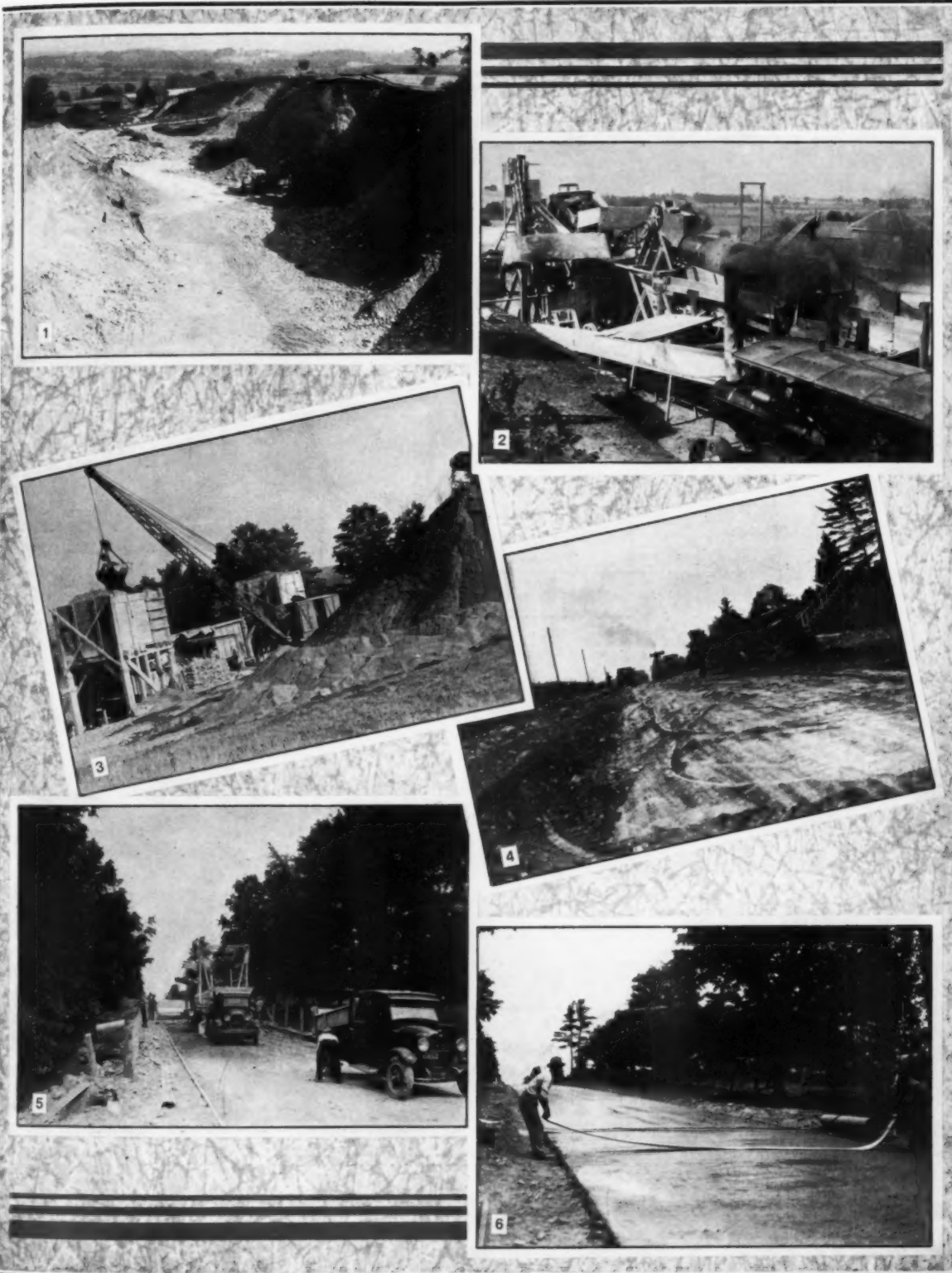
CONCRETING

Wooden forms were used for the concrete. Paving was done by a Koehring 21-E paver. The usual method of finishing was employed and was carried out thus: rakers levelled the concrete; then followed firstly, a heavy and, secondly, a light wooden tamper; then a heavy belt; a roller; and then two lighter belts.

SPECIFICATIONS

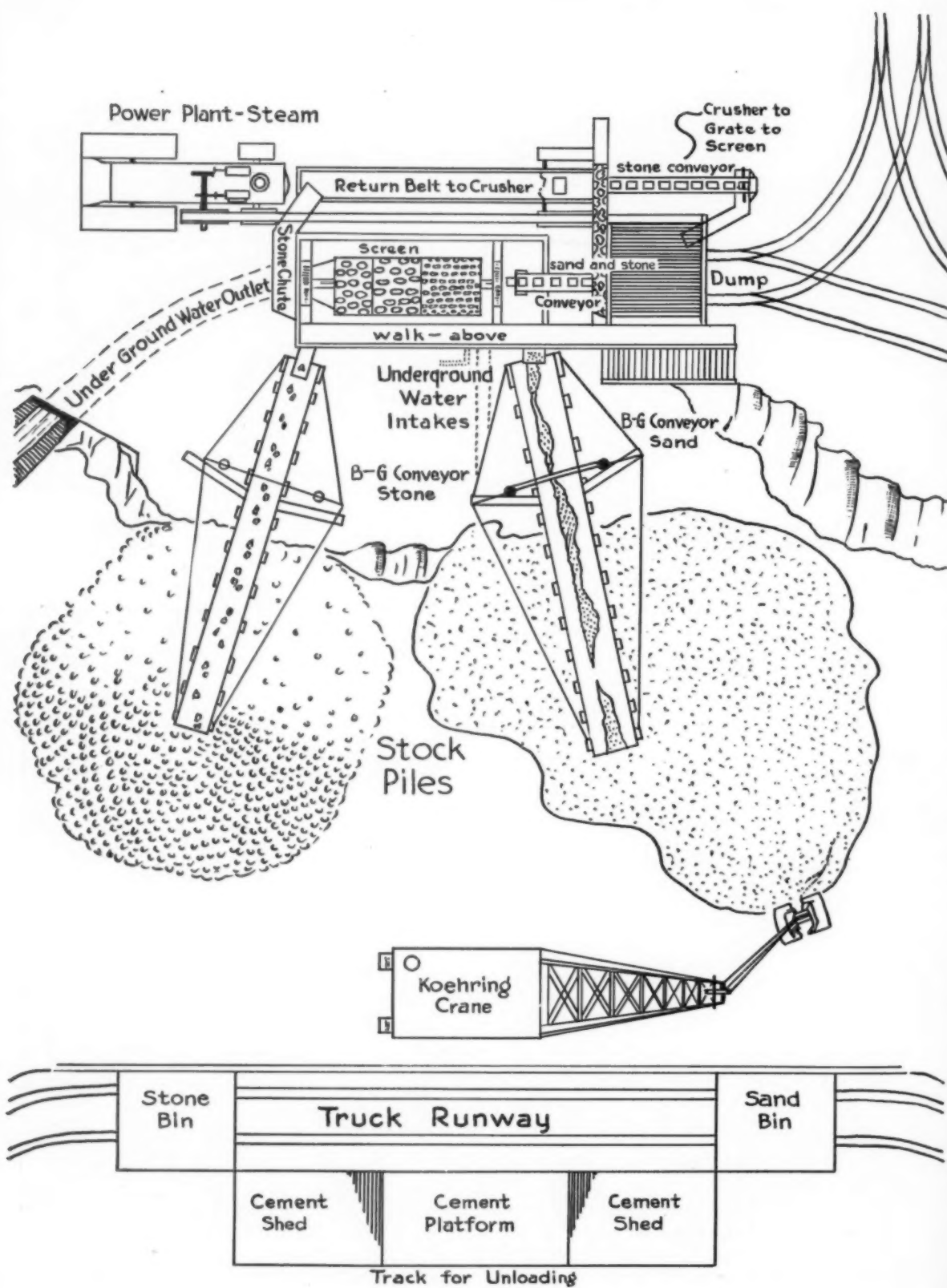
The Department's specifications provide for a 20-foot width, 10 inches in thickness at the sides and 7 inches at the center, the pavement being divided longitudinally by a galvanized steel joint, separating the surface into two distinct 10-foot strips. No transverse joint is used, but the contractor has to provide a bulkhead which is put into position at the end of each day's pour. This bulkhead is so constructed that it allows the new and old cement to form an ideal bond.

The paving mix is $1:1\frac{1}{2}:3$. This is richer than is generally used in many of the States, but on the other hand the specifications allow a shorter period for a mix than generally applies elsewhere. Samples of the surface laid are taken from day to day and forwarded to the laboratory at Toronto as fast as they are sufficiently cured. In this way the inspectors and engineers have a ready check on the strength of the material going into the work. The practice of removing cores from the

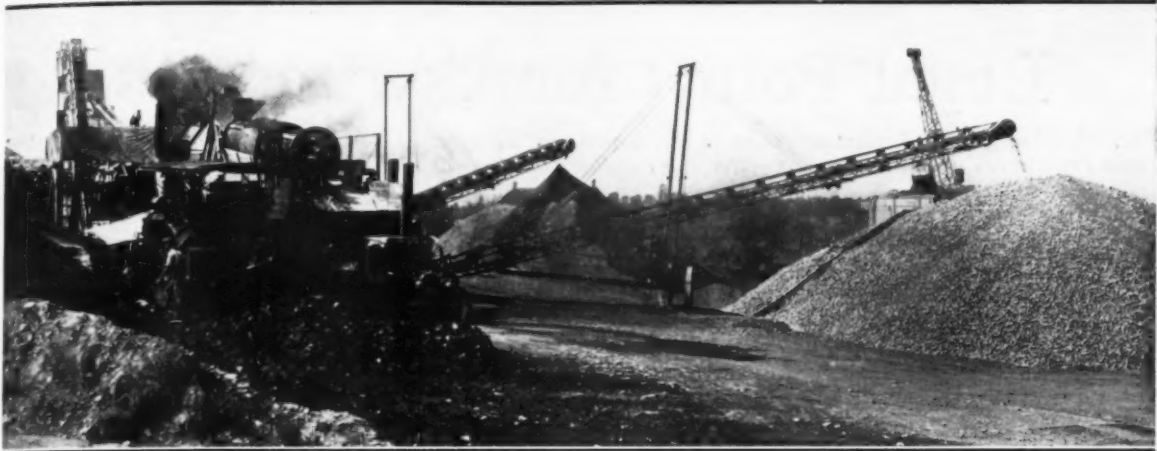


GRAVEL PIT AND CONCRETING OPERATIONS ON THE A. E. JUPP CONSTRUCTION CO. CONTRACT
NEAR OMEMEE, ONTARIO

1. Loading trucks in the gravel pit. 2. Close-up of the crusher and washing plant. 3. Koehring crane filling the loading bins. 4. Rough grading the right-of-way 8 miles west of Omeme. 5. Trucks delivering batches to the paver on the fine grade. 6. Final belting on the green concrete



Plant Layout at the Government-Owned Gravel Pit Operated by A. E. Jupp Construction Co., Ltd., Near Omemece, Ontario



The Gravel Crushing and Washing Plant Showing the Barber-Greene Belt Conveyor Delivering Material to the Stockpiles

pavement and testing the material for depth and strength after pavement construction is not followed in Ontario.

Either mechanical or hand-finishing is permitted by the specifications and in this instance hand-finishing was employed, showing as high a quality as a machine-finished job. Following the final belting of the pavement the road is covered with burlap for a period of 24 hours, being kept thoroughly wet during that time. Calcium chloride, sodium silicate or earth is then applied. Earth was used and in this case it was kept moistened for ten days.

PERSONNEL

K. C. Siddall, Engineer and Superintendent of the A. E. Jupp Construction Co. Limited, was directly in charge of the work.

The Story of the Dome at the National Capitol

THE national Capitol dates back to the spring of 1792 when an advertisement appeared in the newspaper of Washington, Philadelphia and other cities, reading:

"A PREMIUM

of a lot in the city, to be designated by impartial judges, and \$500 . . . or a medal of that value, will be given to the persons who before the 15th day of July, 1792, shall produce for them, the most approved plan for a Capitol to be erected in the city."

A number of plans were submitted and the award finally made. In the center of the approved plan was a dome of wooden framework, copper sheathed. Years of service weakened the dome structure and an addition to the building threw it so far out of proportion that replacement of it had to be seriously considered. In 1855, just before the adjournment of Congress, a bill was passed, providing for new construction.

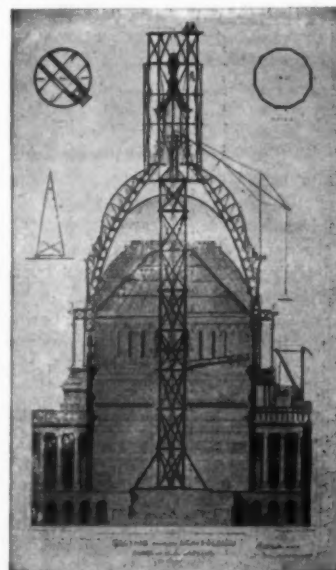
Cast iron was selected for the new work. Captain M. C. Meigs reported:

"Our structure, being built of the strongest material used in construction admits of a lightness and strength which cannot be attained in masonry. At the same time the ease with which a pattern may be repeated in iron, enables us to erect it at a cost far less than anything of the same magnitude and magnificence in another material." And further: "It should be remembered that cast iron is a far lighter material than stone for any building as its strength is so great that it can be used in smaller quantities. For example, the shaft of the columns of the peristyle of the dome weighed 10,000 pounds each. Shafts of the same length and diameter cut from marble would weigh

23,000 pounds." Cast iron was used not only for the members and plates of the dome, but for the columns as well. In the peristyle are 36 cast iron columns 27 feet in height, weighing a total of 422,823 pounds; and there are also 144 pillars 23 feet in height, weighing 4,942 pounds each. The weight of the structure caused many heated discussions in Congress until it was shown that the weight to be supported was only 10,000 pounds per square foot, as against 33,300 for the dome of St. Peter's in Rome and the 39,460 pounds for the dome of St. Paul's in London.

Construction of the dome broke no records for speed. The work was hardly begun when the Civil War broke out. Money had to be conserved, men were needed on the battle line. Orders of the War Department transformed the Capitol into a great hospital with beds in every department of the building. The castings lay on the ground, unprotected from the weather. Work suspended in May, 1861, was commenced again late in 1862, in spite of the War and went forward as well as circumstances permitted. It was completed in 1870.

Statistical figures of the time place the cost of the work at \$900,000, a figure considerably under the amount appropriated. The top of the structure stands 286 feet in height, the total weight of iron is 8,909,200 pounds and the largest casting in it weighs 10 tons.



The New Iron Dome Constructed Over the Old Frame Structure

Legal Points for Contractors

These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

When Contracts Between Same Parties Are Independent of Each Other

"We have a highway contract," said a contracting firm to an Oklahoma crushed stone company, "and are therefore in the market for all the stone and sand that we shall need on the job." The result was a contract to sell the stone at \$1.40 per ton, and another contract to sell the sand at 90 cents.

The stone company became unable to fill its contract as to the stone, because of breakage of a shaft in its crusher. Thereupon, the contractors bought the required stone and sand elsewhere.

In the case of *Maxwell v. Zenith Limestone Co.*, 286 Pac. 879, the Oklahoma Supreme Court decided that the contractors were liable in damages for refusing to permit the stone company to fulfill its contract as to the sand, despite inability to fulfill the agreement as to the stone. The decision turned upon the point that there were two separate contracts. The court said:

"Two separate and distinct contracts were entered into. True, they were signed the same date, and so far as their form is concerned they are practically identical. One, however, provides for the purchase of sand for a particular project, and the other for the purchase of crushed rock at a different price. While they were both to be used in the same project, there is no circumstance tending to show that it was the intention of the parties that it should be one contract."

When the Sewer Backs Up

Of the 47 things that are more unpleasant than sitting on a piece of sticky fly-paper, the contractor will find one of them on coming to his business premises or an uncompleted house to discover that the sewer has backed up over night.

But if he can prove that the resulting damage to the premises or the contents was due to bone-headedness on the part of the city's managers, he will have a good chance of securing judgment for reimbursement, although he may have a long and expensive legal fight to get it.

Through a legal principle that is older than it is just or sound, a city is exempt from liability for a lot of things that an individual or private company would not be under like circumstances. For example, a careless driver on a patrol wagon or fire truck may cause his vehicle to crash through the front of a building and the law will not even require the city to say, "Excuse us." The city in such cases is held, in most states if not all, to be free from responsibility because it was engaged in the performance of a governmental function. This is a sort of survival of the idea that "the king can do no wrong."

But, without a lot of rhyme or reason, the courts hold that there are certain things that the individual or private corporation does not have to stand for. Among these things are careless acts of a municipality in letting sewer clutches slip into "reverse." This is an exception to the general rule of immunity from liability, according to many courts. But the exception is applied only when some real culpability on the part of the city is proved, as by turning storm waters into a sewer known to be inadequate for the purpose, etc.

Being Beaten Up as Part of Employment

If the villain in one of John Barrymore's plays were to make a mistake and sock the hero on the jaw, John's employer would probably concede that it were an accident coming under the California Workmen's Compensation Act and fork up.

But when two of a contractor's workmen get to milling, it is not always easy for the contractor to see why he should pay for the resulting injury to one of them.

The test of the contractor's liability under the compensation act is whether the assault and battery fairly arose "in the course of the employment." Circumstances under which a contractor may be held liable are illustrated by the decision announced by the Pennsylvania Workmen's Compensation Board in the case of *Kline v. Pennsylvania Railroad Co.*, August 21, 1930.

The claimant was in the employ of the defendant as ditch digger. It was pay day and the claimant received his pay check. Shortly before quitting time another of the defendant's employees, who had been working about 30 feet away from the claimant, walked up to the claimant and asked him for his pay check. The claimant naturally demurred, whereupon the other man struck him over the head with a scoop shovel, fracturing his skull. Prior to this occurrence the claimant had never spoken to his assailant and had no personal acquaintance with him. As far as the evidence goes, there was no personal animosity between the two men. Under these facts the Board found that the claimant was injured while in the course of his employment and awarded compensation, saying:

"The defendant offered no testimony, but argues that the claimant's testimony shows that the assault had no connection with the employment; and that it was made because of personal reasons. If this were the fact, of course compensation could not be allowed. . . . It might well be argued that the assault arose out of the employment; that the assailant was attempting to obtain the claimant's pay which he had just received. But whether this view be taken of the case or not, there is absolutely no evidence to show that the attack was made because of reasons personal either to the employee or to his assailant."

Subcontractor Must Take "Fat" with Lien

Although the mechanics' lien laws are very favorable to materialmen, subcontractors and laborers, consideration for the protection of owners is also paid by the courts. The owner is not cut off from all rights that he could enforce against the general contractor, when a subcontractor attempts to enforce a lien.

So, the Oklahoma Supreme Court said in the recent case of *Uhrich Millwork, Ltd., v. McGuire*, 289 Pac. 264:

"In a suit by a subcontractor to enforce a lien against the owner of the building, the owner may offset any actual damages which he has sustained, caused by the contractor's failure to complete the building in time, provided the damages are such as may be said to have been in the contemplation of the parties when the contract was made."

Heavy Regrading and Two Complete Paving Outfits

FOR several years the State Department of Highways of Pennsylvania has had contracts under way for the grading of the scenic highway along the west bank of the Susquehanna River between Lock Haven and Hyner. In the January, 1929, issue of *CONTRACTORS AND ENGINEERS MONTHLY* appeared an article telling of the rough grading of the section running for about 18 miles north from Lock Haven by W. C. Horn Co., of Lock Haven. During the summer of 1930 this stretch was paved for 11.7 miles with an 18-foot, 9-7-9-inch section reinforced concrete pavement by the Kirkpatrick-Wallis Co., of Johnsonburg, Pa. A redesign of the grade made necessary some very heavy grading although the total ran only to 60,000 yards. The work was all in rock running from disintegrated shale to a heavy rock from which flagging was produced at one section of the job by a local quarryman.

GRADING IN THREE SECTIONS

Except for three sections the grade was in very good condition as far as elevation was concerned, although it caused no end of trouble trying to set the forms to grade in shale. A Northwest 1-yard gas shovel and two Erie steam shovels, one a $\frac{3}{4}$ -yard and the other a $\frac{7}{8}$ -yard machine, were used for the excavation. Each shovel was served by two or three Mack and International trucks, as all the spoil had to be hauled back toward Lock Haven, there being certain restrictions on the river bank directly below the right of way that made it impossible to waste the excavation.

TWIN BATCHING PLANTS

At a point about 6 miles from Lock Haven where the contractor for the grading three years ago had located his construction camp, the paving contractor set up his

*Kirkpatrick-Wallis Co.
of Johnsonburg, Pa.
Doubled the Concrete Crews
and Equipment to Complete
11.7-Mile Concrete Job
at Lock Haven, Pa.
on Schedule*

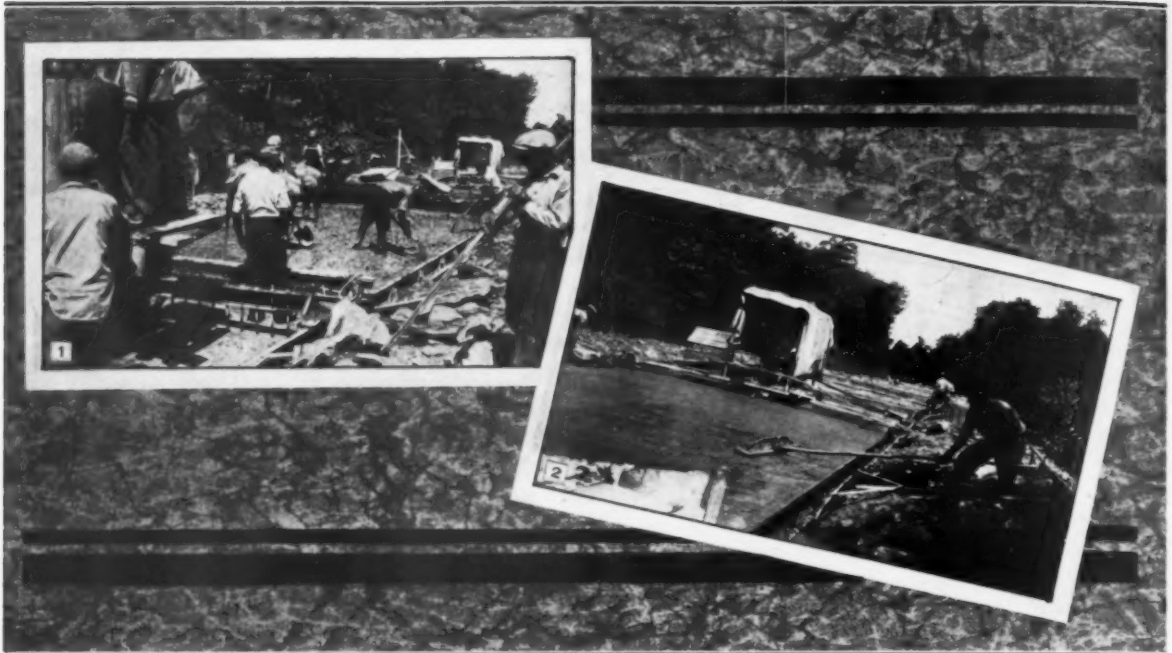
batching plants. The site was served by a spur track which was used to bring in the stone, sand, cement, and all equipment, as the trip over the road was very difficult for any but rough riders and the hauling of heavy equipment was out of the question.

One paver was started at the end of the job farthest from Lock Haven and worked toward the batcher plants. The second paver

was started at the Lock Haven end somewhat later, as the grade was not completed until August 8 and hauling was not possible. The first batcher plant to be put into operation consisted of an Erie steam crane with a 40-foot boom and an Erie $\frac{3}{4}$ -yard Multi-power clamshell and a Blaw-Knox weighing batcher. The second plant was served by another Erie steam crane with a $\frac{3}{4}$ -yard Blaw-Knox clamshell and had an Erie AggreMeter.



A Nice Cool Location with Trees All Around—But When This Picture Was Taken One Pit Man Had Just Been Laid Out by the Terrific Heat of the Sun Reflected by the Dazzling Dust of the Subgrade



ACTION ON A NEW SCENIC HIGHWAY IN PENNSYLVANIA

1. A view of the scratch template, pit men, finishing machine and Cleft center point machine from beside the Ransome 27-E paver. 2. The Cleft machine operator was protected from the sun by a well made canopy. Hand floating in the foreground

Sand was received in gondola cars over the spur track from the West Branch Sand & Gravel Co., Williamsport, Pa., and was clammed out directly to the batcher or to the stockpile. The stone, from the White Rock quarries of the Bellefonte Limestone Co., at Pleasant Gap, Pa., came in hopper-bottom cars and was dropped into a pit from which it was clammed. A small amount of Hercules cement was used at the start of the job, and then later 650 barrels a day of Universal Atlas cement was used by each paver. The cement was unloaded on a construction spur at the plants and two men in the car loaded the six bags on each batch. Each batcher plant had two men in the cars cleaning up, a crane man and oiler, and a batcher man as well as the two men loading cement. The individual batches were made up of 1,236 pounds of sand, 1,992 pounds of stone and six bags of cement.

For hauling the batches a fleet of thirteen International trucks about evenly divided between 2-batch and 3-batch capacities were used for the maximum haul for each paver. The pavers averaged close to the theoretical maximum of batches mixed per hour on this job with a 1¼-minute mix, placing 35 per hour on the road.

FINE GRADING AND FORM SETTING NO SNAP

When a cut of an inch or two with a big grader will expose a huge slab of shale that cannot be displaced with a pick and crow bar, the question of fine grade assumes interesting proportions. There were frequent pops where outcrops of rock had to be broken up with light charges of explosive. Many of the sharper outcrops could be hand-sledged satisfactorily.

A 9-foot Galion leaning wheel grader pulled by a Caterpillar Sixty cleaned up most of the grade, while a Cletrac 30 with a Baker rotary scraper was very

handy in cleaning out the high spots after the Buffalo-Springfield 10-ton steam roller had scarified them. A Huber 10-ton gas roller was also used to compact the new fills where the grade was raised by the new profile. A Russell 9-foot blade grader was also used on some sections for the fine grading. The fine grade crew consisted of about twenty-four men and a foreman.

The form trench was cut by a Carr formgrader where possible and at other places by hand where the shale was predominant. The fine grading crew handled all the hand work for the form trenches. The Carr formgrader reciprocated by wading in and cutting out many of the high spots in the grade so that the rotary could pull them out in a hurry. The Carr machine cut high spots up to 9 inches very satisfactorily.

The contractor had 3,500 feet of 9-inch Truscon forms on the job, there being no use for the smaller forms as the slab was poured the full 18 feet wide. The forms were maintained about 1,500 feet ahead of the paver which poured about 750 feet per day. After the forms were set the fine grade crew used a homemade scratch-board made of a 4-inch plank cut to the contour of the road and with adjustable sharpened bolts run through the plank to check the grade. A Hug subgrader was used to plane the grade to final shape. A Buffalo-Springfield 5-ton gas roller was used to compact the final grade ahead of the paver.

LAYING THE SLAB

The trucks with the batches turned through the forms and backed a minimum distance to the pavers. Two men handled the emptying of the cement onto the batches as the trucks awaited their turns at the skip. One man on the shoulder baled the bags and saw that they were returned to the plant for credit. One very ac-

tive man handled the dumping of the trucks and assisted the other laborers close by as occasion required. The organization described is for the first paving unit. The second was a duplicate as far as labor was concerned, although in some instances different makes of equipment were used.

The Ransome 27-E, 1930 model paver, carried the operator, and the calcium chloride man, who picked up the bags of Columbia calcium chloride that had been distributed along the shoulder and made the solution as required by the paver. Behind the paver were two clean-up men on the grade, who shoveled out the drippings from the paver bucket and used the scratch template and sprinkled the grade after removing any high spots. There were four pit men and two spaders, who assisted each other in placing the reinforcing fabric and steel at the joints and cross dowels at the center joint.

The surface was finished by an Ord finisher with one operator followed by two hand finishers and an edger. These men handled the long-handled lutes or paddles and the burlap belt. The pit men shoveled to the strike-off of the finishing machine if necessary, but the paver operator was careful to place sufficient concrete near the strike-off so as to minimize this labor.

The center joint was placed by a Cleft center joint machine run by one man and a helper. The helper went forward to assist the two men who realigned and reset the forms. There were also two regular form setters ahead. A steel strike-off was used for cutting down the

concrete to 2 inches below the forms for the placing of the reinforcing steel. This Chain Belt strike-off was on rollers and performed the job neatly and effectively. On this particular job the concrete was very well placed so that the strike-off had a minimum of material to move. It really acted more as a check board.

There were two men placing burlap, two men sprinkling and two men who carried the burlap forward after it had been on the slab for the full 24 hours specified.

THE UTILITY UNITS

There was a truck which carried a large tank of water along the job for the steam shovels, as it was not economical to install pumps for each shovel and pump from the river 50 to 100 feet below. Another truck carried the gasoline tank for the gas equipment, and a stone sled was used most effectively to haul the forms forward each night. The shoulder on the river side was practically non-existent in many places, and the cliffs ran high on the other side so that a sled was about the only piece of hauling equipment that was practical.

PERSONNEL

John Kirkpatrick and E. N. Wallis are the owners of the contracting organization, Kirkpatrick-Wallis Co., Johnsonburg, Pa., the contractors for this job. Mr. Kirkpatrick was the active member on the project, with Clark Metzger as Superintendent. For the State Department of Highways, P. R. Nicholas was Chief Inspector.

\$ 1

for
an Idea

AS we were sitting in front of the shack that served as a field office for the contractor and the state engineers, the Superintendent said to me,

"I learned a lesson from a darky laborer the other day that made me sit up and realize that there are none in this world from whom we cannot learn something."

They were setting up a Cummer asphalt plant and it was slow work moving the heavy machine into place on skids with planks on the ground and 2-inch pipes for rollers. The laborers were straining at the pinch bars and crow bars they were using to edge the machine along the planks and every minute or two one of the laborers would whine,

"Ah wants a Stillson. Has anybody a Stillson?"

The Superintendent paid no attention to it until his son who was visiting the job that morning said,

"Dad, that man is asking for a Stillson, why don't you give it to him?"

After the whining request had been repeated a few more times the Superintendent was disgusted and called out,

"Bill, for goodness sake give that nigger a Stillson and see what he wants of the thing."

The darky was overjoyed and grabbed the wrench as soon as it was given to him and took a grip on a

*A Negro Laborer
Whines for a Stillson
and
Shows the Way for
Greater Speed*

piece of one of the pipe rollers that was sticking out and with almost no effort was merrily rolling the heavy machine along almost alone, except for the lining up of the men with pinch bars on the other side. The Superintendent was so happy that he took out a dollar bill from his pocket and handed it to the laborer saying, "Well, Boy, you showed me one that time and after this you shall all have Stillsons when we are moving the plant."

Sure enough, now every time the heavy parts of the plant are being moved along every one of the laborers has a Stillson and he hooks onto the pipe nearest him and with the love of synchronized action that is inherent to that class of labor they chant softly and all pull on the wrenches at the same time and the plant rolls into place in a tenth of the time with no energy wasted.



The Editor Comments —

The Contractor's Side of Charitable Municipal Employment

In our Comments in January, we mentioned the work which is being done by the City of Newark, N. J., in handling the excavation of about 170,000 cubic yards of material from the bed of the old Morris Canal to convert it into a sub-surface roadway. Most of this work during the winter is being done by hand labor as a means of reducing unemployment.

A New York excavating and paving contractor has written, calling our attention to the cost of excavation on this project. Through personal observation, he points out that each man is loading approximately one-half yard of material per day and is paid \$5 for eight hours of labor. This makes the cost of loading the material \$10 per cubic yard. This contractor offers the following suggestion for solving the Newark problem in a manner which would help shovel or excavating contractors and, at the same time, make it possible for the city to pay its unemployed a living wage.

First, he would let the loading of the material at 20 cents per yard to some shovel contractor. Then, he would intern the present workers in an armory or other suitable steam-heated building with comfortable chairs from 8 A.M. to 5 P.M. This would maintain the 8-hour day. Free lunch could be served and under pleasanter conditions than out on the job. A radio or other form of entertainment should be continuous to keep the men from brooding over their lot. On pay day they would be paid at the rate of \$4.90 per day, the 10-cent reduction in pay taking care of the contractor's dirt loading costs.

Our contractor friend believes that this suggestion has the advantage of putting additional men and trucks to work. It eliminates the hazard to life and limb searching for wood and stoking bonfires with subsequent dangers of grippe, influenza and pneumonia and he has wept copiously at watching the uninitiated try to use a pick and shovel which is both a pathetic and hair-raising sight. He feels that the element of self-respect, of which we hear so much, can, in general, be disregarded. "The idea of giving value for wages," he remarks, "went out of style in the early days of the War."

While hundreds of philanthropically-minded gentlemen and gentlewomen would probably become hysterical upon considering these suggestions, practical-minded individuals can see in them as much good actually done and more economic returns for the investment of money than in the payment of \$10 a yard for excavation by amateurs.

Reduction in Construction Costs

One of the most interesting examples of reduction in construction costs that has come to our attention is in North Carolina, where the Proximity Manufacturing

Co., the largest manufacturers of denims in the world, is building a complete sewerage system for the villages of Proximity, Revolution and White Oak, totaling about 1,500 houses for 8,000 people. Ten years ago a sewerage system was designed for the village and the engineers prepared an estimate of cost. The contract has only recently been let and work was started in an endeavor to help out the local unemployment situation. The bids for this work are less than 60 per cent of the estimated cost in 1920.

Shall We Quit Machines for Hand Labor?

In the March issue of *THE EQUIPMENT DISTRIBUTOR*, William H. Ziegler, President, General Tractor & Equipment Co., Minneapolis, Minn., discussed the question, "Are New Machinery and Inventions the Cause of Unemployment?" He presented a very strong case for the use of machinery in a logical manner. Mr. Ziegler has just written us, calling our attention to an instance which has happened in New York City since then which shows rather definitely that the average man does not want to get away from the machine age. He writes:

"The question was referred to in the article about not being able to secure men to do the work they used to do thirty years ago. Our Minneapolis papers carried the statement recently that in New York City they had some 17,000 men using scoop shovels to clear the snow off the streets, but found it impossible to keep enough men employed to do the work, as they kept quitting all the time. In other words, men didn't want to do that kind of work any longer, notwithstanding the fact that our papers stated they were paid \$5 a day for 8 hours work.

"It isn't a question any longer whether we want these machines and improved methods of doing things, but rather a question that men are not what they used to be—that is, they will not labor. They haven't the physical strength to labor as they used to. The recent experience in New York City is proof of that statement and it can be verified in as many cities as there are in the country. If we attempted to do the work that we are doing today and asked men to do the labor that machines are doing, a cry of slavery would go up from unions that would shake the country. Therefore, why discuss or talk about a thing that is past and cannot return.

"This country has always been a forward-looking country. Those who want to look back ought to go over to China where they live entirely in the past and think more of the preservation of their dead ancestors' graves than they do in the rearing and improving of their children."

Theodore Reed Kendall

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A Section of
CONTRACTORS
AND
ENGINEERS MONTHLY

Devoted to
News of Consultants
in the
Civil Engineering Field

The Consulting Engineer

March, 1931

New York

Vol. III, No. 3

Soil Technology in Drainage, Irrigation, and Turfing

Report from Office of Wendell P. Miller and Associates



Wendell P. Miller

MILLER AND ASSOCIATES, Consulting Engineers, 105 West Monroe St., Chicago, have developed the technique of dealing with soils and soil problems through the application of soil technology as developed in the State agricultural colleges.

Applied soil technology is of utmost value in the control of grading operations on large areas which are to be turfed or otherwise surfaced, in the control of subsurface drainage design for these areas, and for the determination of irrigation water requirements. There is a further application in soil conditioning, fertilizing, and in the development of fertilizer formulæ.

The Miller organization has recently completed designs for the subsurface drainage and surface water control for the Massachusetts Air Terminal at Boston, where a 1,200-acre field of muck and peat on quick-sand is being converted into one of the largest and most complete airports in the East. The plans were drawn for Merick-Wildish & Co. of Chicago, Airport Engineers, who are consulting engineers for the entire project.

As a result of the drought there has been much interest in the irrigation of turfed areas, and the Miller organization has benefited accordingly, having under way or just completed fairway irrigation and water supply

DIFFICULT soil problems in connection with drainage and irrigation of large areas have given rise to a specialized practice in soil technology, consisting mostly of consultation on soils and difficult subsurface drainage design for various project engineers.

By confining their activities largely to turfed areas, airports, industrial, recreational and burial areas, and private estates, WENDELL P.

projects for South Bend Country Club, Albany Country Club, Oak Park Country Club, Chicago, Wakonda Country Club, Des Moines, Queens Valley Golf Club and Women's National, both Long Island. All of these irrigation projects, except one, are of the hoseless type.

Another field of activity covered by this organization is the supervision of construction of large turfed area projects. A large project recently completed is the new 36-hole course of the Jockey Club of Buenos Aires, where ground was broken on February 15, 1930, and the entire course opened to play on December 1, 1930, a complete construction and turfing job, including lakes, gravel wall wells, subsurface drainage, and the entire change of a flat landscape completed and turfed in nine and one-half months, an all-time record in golf construction. This is the first time American dirt moving methods were ever used on recreational construction in South America. This project cost around \$350,000 United States currency. The Miller organization is carrying on a number of drainage, irrigation and construction projects in the Argentine.

During 1931, Mr. Miller expects to construct a remarkable golf course on unusual terrain between two arms of Lake Placid, N. Y., for the new and exclusive Adirondack Club, as well as a large project for the Mackinac Shores Club of Grand Rapids on its property along the mainland beach south of Mackinac Island.

Mr. Miller is an Agricultural Engineer, graduated from Ohio State University and Member of A.S.A.E. Associated with Mr. Miller is Dr. George M. McClure, Professor of Soils in charge of the Soils Department, Ohio State University.



Prof. Geo. McClure

The Consulting Engineer

A Section of
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Municipal Projects of Texas Engineers

ACCORDING to a recent report from the offices of MONTGOMERY & WARD, 545 Harvey-Sneider Building, Wichita Falls, Texas, this company has been appointed consulting engineers for Yoakum, Texas, on the complete municipal light, power and water works systems, contracts for which were let on February 7, at an approximate total cost of \$500,000. Plans for city paving and drainage are being prepared for Midland, Spearman, and Taft, Texas.

Following the appraisal of the privately-owned sanitary sewerage system at San Marcos, Texas, by this firm, San Marcos purchased the sewerage system and voted bonds for sewerage extensions and a new disposal plant, for which plans are now in preparation by Montgomery & Ward. A city plan for Pampa, Texas, was completed and delivered during February.

Pipe Line Project in Kentucky

AN emergency water supply pipe line for the Lexington Water Co., was recently completed under the supervision of HOWARD K. BELL, 727 McClelland Bldg., Lexington, Ky., who prepared the plans and supervised the construction of the project. The work involved the construction of a 7-mile, 20-inch cast iron pipe emergency line to the Kentucky River from the present reservoirs of the company, a 20-inch steel pipe extending down the gorge of the Kentucky River, a height of 350 feet, a 4,000,000-gallon daily electric-motor-driven pumping plant at the river and a power line from the present station, the power being furnished by the Kentucky Utilities Co.

Plans for a storage dam for the Lebanon Water Co., Lebanon, Ky., are being prepared by Mr. Bell and his associates, Grant S. Bell and James K. Latham, and the construction on the electrification of the Versailles, Ky., water works was carried on under their supervision.

Charges for Engineering Services

THE American Society of Civil Engineers has prepared two manuals of engineering practice, Number 5 and 6, from the report of its Special Committee on Fees. Manual Number 5 is for consulting engineers and Manual Number 6 is for clients.

These important manuals discuss the problem of payment for professional services with relation to ethics and codes of practice and the basic factors to be considered. Following this, specific topics are discussed in considerable detail including contracts for service, the general method for computing charges including percentage of cost, the fixed lump-sum fee, per diem rate, hourly basis, salaried service, retaining fees, and contingent fees. There is also a section devoted to that all important item of overhead which even some consulting engineers fail to consider. The concluding chapters take up a number of special cases including unfair competition for private work, arbitration, appraisals of properties, building construction and fees for that work, the relations of engineer and contractor in structural and bridge steel design, the architect in bridge design, public service and governmental employment, competition for prizes, ownership of design, continuing employment, bad debts, cost of engineering in public work, rates for services, and a page on the education of clients and engineers and a one-page bibliography.

Consulting Briefs

Fay, Spofford and Thorndike, 44 School Street, Boston, Mass., is now supervising the final stages of construction of the water distribution system for Warwick, R. I., and the addition to the water supply system for Gloucester, Mass. It is also engaged in preparing plans and specifications for the water distribution system of Pembroke, Mass., and is assisting the Town of Scituate, Mass., in its investigation of the private water supply company there. It is acting as consultant to the City Engineer in the construction of a dike at Hartford, Conn., and to the Chief Engineer of the Portland Terminal Co. in its waterfront development at Portland, Me. In cooperation with an architect it is supervising the construction of a garage and service station at Cambridge, Mass., and is preparing plans and specifications for schoolhouses at Arlington and Boston, Mass.

Koch & Fowler, 801 Central Bank Bldg., Dallas, Texas, are preparing plans for a \$20,000 sewer system and disposal plant for Irving, Texas, and for the Preston Road Fresh Water District, Dallas, to cost \$175,000. The water works at Monahans City, Texas, the cost of which is \$25,000, has just been completed under their supervision.

Sven A. Norling, Consulting Engineer, 343 Gateway Bldg., Minneapolis, Minn., is at present preparing plans for a 5,000-acre reclamation project 10 miles north of Minneapolis. The construction of a sanitary sewer, water works and disposal plant at Princeton, Minn., and drainage works near Elk River, Minn., is going on under Mr. Norling's supervision.

Howley, Freese & Nichols, 411-17 Capps Bldg., Fort Worth, Texas, are preparing plans for the water supply at Beaumont, to cost \$1,000,000; a sewage treatment plant for Dallas, at a cost of \$1,700,000 and a \$500,000 filtration plant at Fort Worth. The construction of the \$6,500,000 flood control project at Fort Worth; the water works at Refugio, costing \$100,000; water supply for Sweetwater, to cost \$700,000 and the sewerage system for Big Spring, \$100,000, is being carried on under this firm's supervision. This company was called as expert witness in the case of the City of Austin vs. Austin Dam, Inc. H. C. Pfannkuehe recently joined the staff.

R. K. Tiffany and Lars Langloe, 419 Security Bank Bldg., Olympia, Wash., are working on plans for the improvement of the Clarkston, Wash., water system, including irrigation and domestic supply projects, and also on improvements for the Franklin County, Wash., Reclamation District, and the Black Lake, Wash., drainage project.

William L. Rockwell, 820 Cambridge Oval, San Antonio, Texas, and Eagle Pass, Texas, is preparing plans for the Zavala County Water Improvement District No. 2 for the irrigation of 40,000 acres of land in Zavala County, Texas, and for an irrigation project of 75,000 acres for Coke and Runnels Counties. Mr. Rockwell is also supervising the construction of the \$8,000,000 Maverick County Water Control and Improvement District No. 1 project, for which 375,000 cubic yards of earth was placed, 80,000 cubic yards of rock removed and 1,000 cubic yards of concrete poured during the month of November. W. H. Brown and Percy A. Fagan, Field Assistants, recently joined Mr. Rockwell's staff.

H. A. Marshall, Consulting Engineer, 108 West 9th St., Topeka, Kans., is preparing plans for a bridge across the Marais des Cynes River at Osawatimie, Kans. This is to cost approximately \$40,000. Mr. Marshall is also supervising the construction of bridges in Miami County of spans of from 30 to 80 feet.

Westcott & Mapes, Inc., 139 Orange St., New Haven, Conn., are preparing plans for the administration and equipment buildings for the New Haven Airport as well as for the field lighting of the airport. On January 23, Carl W. Taylor, Secretary of the company, delivered a lecture at Mason Laboratory, Yale University, before the local section of the American Society of Mechanical Engineers on "Engineering As Applied to the Selection and Design of Airports".

C. N. Harrub Engineering Co., 705-9 Fourth and First National Bank Bldg., Nashville, Tenn., are preparing plans for water supply for Walton, Ky., and for paving for Aberdeen, Miss., and Glasgow, Ky. They are also supervising the construction of water supply improvements for Murfreesboro, Tenn.

W. B. Rollins & Co., Consulting Engineers, 339 Railway Exchange Bldg., Kansas City, Mo., are at present engaged in the preparation of plans for an extension to the sewage disposal plant at Harrisonville, Mo.; a water softening plant for Norborne, Mo.; a water purification plant for Memphis, Mo., and a water softening plant at Platte City, Mo. A water works and sewerage system for Belton, Mo., a water works system for Platte City, Mo., extensions to the sanitary sewer system at Vandalia, Mo., a sanitary sewer system for Wellsville, Mo., and paving projects at Rich Hill and Parkville, Mo., have recently been completed under this company's supervision.

J. R. Pennington, Carson City, Nev., is preparing a report on the public water supply for Fallon, Nev.

E. F. Layman, 514 Main St., Cincinnati, Ohio, has been called as an expert witness in ex parte proceedings regarding the right-of-way of the C. C. & St. Louis Railway from Cincinnati to North Bend on the location of original lines.

Pate, Hamann & Hirn, Detroit, Mich., have recently moved from 922 Transportation Building to 1609-10 Washington Blvd. Building. This company is at present engaged in preparing plans for drains and back water gates for Drainage District No. 3, Wayne County, Mich.; sewage treatment for Sandusky, Mich.; improvements to the water supply for Almont, Mich.; sewers and sewage treatment for Flushing, Mich., and sewage treatment for Hillsdale, Mich.

Howard R. Green Co., Engineers, Cedar Rapids, Iowa, is preparing plans for intercepting sewers and a sewage pumping plant for Cedar Rapids; sewage disposal plants for Bloomfield and Monona, Iowa; paving for Riverside and Monticello, Iowa; a swimming pool for Marengo, Iowa; a swimming pool and park development for Manchester, Iowa; a swimming pool for Traer, Iowa, a storm sewer system for Tama, Iowa, and transmission line development for the Iowa Railway & Light Corp.

Construction, Evaluation and Litigation

ACCORDING to a report from M. H. Doyme, C. E. SMITH & COMPANY, 1752 Railway Exchange Building, St. Louis, this company is now engaged in a wide variety of construction supervision, appraisal and evaluation proceedings and litigation. It is designing and supervising the construction of five elevated railroad approaches to the St. Louis Municipal Bridge and the estimated cost is \$3,500,000. Work is under way on the appraisal of the St. Louis National Stock Yards for rate making purposes before the U. S. Department of Agriculture.

C. E. Smith & Co., is representing the City of St. Louis in an electric light and power rate case before the Missouri Public Service commission and representing the Litchfield & Madison Railroad and the LaSalle & Bureau County Railroad in hearings before the Interstate Commerce Commission on the recapture of excess earnings.

A report is being prepared on the Downtown Union Station at New Orleans, La., for the Louisiana Public Service Commission, and appraisals are being made on the right of way and real estate of railroads in the St. Louis, East St. Louis district in connection with the Federal valuation of railroad properties by the Interstate Commerce Commission.

Mathematics of Design for Brickwork

THE method adopted for reinforced brickwork by engineers in India, who have had more experience in this type of construction than all other engineers, is essentially one of trial and error. The principles of design and the formulae are the same as used in reinforced concrete. Long and successful experience, combined with extensive laboratory research, makes their practice a safe guide and safely applicable to work in this country. All factors, except brick strength, are practically alike and the Indian brick are much weaker than those made in this country. The Common Brick Association, 1716 Grand Central Terminal, New York City, has published a booklet on the "Mathematics of Design for Brickwork" written almost entirely from Technical Paper No. 38 of the Department of Public Works of the Government of India. A limited edition of this paper has been prepared and, until exhausted, copies may be secured by engineers from the Common Brick Association.

Activities of Chicago Engineers

AREPORT from MARR, GREEN & OPPER, INC., 400 North Michigan Ave., Chicago, Ill., states that plans are now being prepared for a State Park at Galena, Ill., the estimated cost of which will be \$75,000; a reinforced concrete highway bridge, to cost \$20,000 and street paving to cost \$125,000. They are also preparing a special report on street improvements in the Elmwood Park District, at a cost of \$500,000, as well as plans for ornamental electric lights for Golf, Ill., at a cost of \$10,000, a street opening and electric lights in Glenview, Ill., to cost \$50,000 and a storm and sanitary sewer at a cost of \$125,000.

The construction of a \$150,000 pumping plant and the installation of electric lights at a cost of \$15,000 and street paving at a cost of \$40,000, for Riverside, Ill., are going on under this company's supervision. They have

also been called as expert witness in the Chicago Daily News and Sanitary District of Chicago bridge path and other litigations, \$2,300,000; the Hinsdale Golf Club vs. Village of Clarendon Hills, no cost; and the LaGrange-Hoffman case, involving the Desplaines River flow-dam.

Can the Engineer Supply the Missing Balance?

THE following two paragraphs have been selected from the address of CHARLES BROSSMAN, consulting engineer, Indianapolis, Ind., in his address to the Indiana Engineering Society as its retiring president. Mr. Brossman's remarks are very pertinent in the present economic situation and are worthy of the consideration of each individual professional engineer and local engineering organization:

"Our experience over the last year has brought out the lack of coordination and control of our complex industries and social world. We are out of balance; the governing apparatus to keep the engine and other machinery at a safe and constant speed is lacking in our economic system. The entire mechanism either runs away at top speed or stops entirely. That has happened in the past year. Our industrial unit is again endeavoring to reach equilibrium, but the trouble will recur if the protective apparatus is not properly designed and efficiently controlled.

"This equilibrium must be found; the peak load and the no-load must be ironed out to produce in the parlance of the power house man, a good 'load factor.' This is one of the problems to which the engineer should give thought. He cannot solve it alone, but he can be largely instrumental in rectifying the situation."

Notable Reduction in Construction Costs

A CONTRACT has been let by GILBERT C. WHITE Co., Consulting Engineers, Durham, N. C., for the Proximity Manufacturing Co., Greensboro, N. C., for the construction of a complete sewerage system for its villages of Proximity, Revolution and White Oak. These three villages comprise about 1,500 houses and approximately 8,000 people. The contract was let to Tucker & Laxton, Inc., Charlotte, N. C.

The Proximity Manufacturing Co. is probably the largest manufacturer of denims in the world. It uses in its manufacturing processes and in the villages around 1,000,000 gallons of water a day and consequently has its own filtration plant which is operated by the company. Ten years ago a sewerage system was designed for the village and an estimate of cost prepared. It is interesting to note that the contract as let will get the same work done for less than 60 per cent of the cost in 1920. This company is having the work done at this time because of the unemployment situation and because of the very favorable prices obtainable. It is estimated that it will cost approximately \$250,000 for complete sewerage and plumbing installations.

William Judson Gray, Springfield, Mo., who for the past seven years has held the position of Engineer and Superintendent of the Springfield Water Co., resigned on January 7 and opened an office in the Holland Building, to carry on an engineering practice. Mr. Gray is a member of the American Society of Civil Engineers, the American Water Works Assn., American Concrete Assn., and the American Public Health Assn.

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with contracts that must be finished on time and at the lowest cost.



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For STRIPPING:

From shaving six-inch topsoil to cutting a six-foot trench in anything but boulders, rock or cypress swamp

IT STRIPS.

For FINISHED GRADING:

Cutting close to the grade stakes, smoothing down the rough spots and cleaning up the dirt as it goes along

IT FINISHES.

For DIGGING:

Whether cut-and-fill or borrow-pit, put it right into the bank—2 to 2½ yards a minute,—and make your trucks hustle

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At the stockpiles with the accurate adjustable Nelson Batcher, and you can deliver on schedule to your mixer

IT BATCHES.

For Just LOADING:

Stone, earth, sand, gravel, ashes and dozens of odd jobs—into big trucks or little trucks, high trucks or low

IT LOADS.

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It does not pay to shovel by hand when one Nelson



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Construction Industry News

American Rolling Mill Co., Middletown, Ohio, has recently organized two new departments, including a pipe manufacturing department in the Middletown Division with C. C. Clarke as superintendent which, in addition to spiral welded pipe, makes other factory products. Armeo's sales activities in the pipe field will be under the direction of the Spiral Welded Pipe Department, Sales Division, which has just been established as a separate department of the sales division, with R. C. Beam as Manager, assisted by H. M. Ives.

Bethlehem Steel Corp., 25 Broadway, New York, has announced that G. H. Blakeley has become President of the McClintie-Marshall Corp., in conjunction with the agreement by which the Bethlehem Steel Corp., acquires the McClintie-Marshall interests. Mr. Blakeley has been for many years a prominent figure in the field of structural engineering and has had an active part in many of the developments which have fostered modern skyscraper and bridge construction. He became Vice President of Bethlehem Steel Co. in 1927, having entire charge of structural steel operations in the company. He was manager of the structural steel department from 1908 to 1927 and President of Bethlehem Steel Bridge Corp., from 1916 to 1923, when it was amalgamated with the division of the company which he has directed to the present time.

Good Roads Machinery Co., Kennett Square, Pa., has announced that a decree of the Federal Court was issued on March 4 placing the company in a receivership in equity. Earle S. Philips and Robert V. Bolger were appointed by the court as co-receivers to operate the business. The receivership is a friendly one to effect an early reorganization. Mr. Philips has been Vice President and General Manager for several years and it is believed that the present action will be advantageous to all parties. The company is solvent and it is expected to take care of all obligations promptly.

Bucyrus-Erie Co., South Milwaukee, Wis., has acquired a controlling interest in the Monighan Manufacturing Corp., Chicago, Ill., makers of a complete line of diesel and electric dragline excavators mounted on the patented Monighan walking device. The Monighan Mfg. Corp., will continue to operate as a separate company and the management will remain the same as in the past with O. J. Martinson continuing as President. Beginning March 1, the sale of the Monighan products in the United States and throughout the world is to be handled exclusively by the sales organization of Bucyrus-Erie Co.

Link-Belt Co., 910 South Michigan Ave., Chicago, Ill., has announced the appointment of the Stockland Equipment Sales Co., 2628 University Ave., S. E., Minneapolis, Minn., as its shovel-crane-dragline agents in Minnesota, excepting a few counties around Duluth and for part of central west Wisconsin.

American Hoist & Derrick Co., St. Paul, Minn., Dominion Bridge Co., Ltd., and Dominion Engineering Works, Ltd., Montreal, Canada, have announced the formation of a sub-

sidary company to manufacture and sell in Canada and the British Empire the American Hoist & Derrick Co. line of power shovels, locomotive cranes, hoists, derricks, full-circle large capacity cranes, rail cranes and the entire American line of hoisting, excavating and material handling machinery. The subsidiary will be known as the Dominions Hoist & Shovel Co., Ltd., and the products will be known as the "Dominion" line which will be built and serviced at the Lachine, P. Q., works near Montreal.

Mussens, Ltd., Montreal, Canada, will be in a position to furnish throughout the Dominion of Canada the following products of the Good Roads Machinery Co., Inc., Kennett Square, Pa.: Good Roads and Climax crushing equipment, Good Roads power graders, drawn graders, road drags, bituminous distributors, cold application distributors, chip spreaders and the Good Roads line of high speed snow plows.

The Bond Co. has moved its offices and warehouses from 84 High St., Boston, Mass., to Dorchester Avenue and Old Colony Avenue, South Boston, Mass. This distributor represents National Equipment Co., Novo Engine Co., C. S. Johnson Co., and others.

Universal Crusher Co., Cedar Rapids, Iowa, manufacturer of stone and gravel crushers, is making a change in its distribution policy. All equipment sales, in the future, will be handled direct with the user or through local jobbers. Satisfactory dealer connections which have been established for many years will be retained and new connections made in all other sections of the country. Stocks that have been carried at strategic points will be transferred to the Universal Crusher Co.'s own agents.

Distributors' Bulletin Board

The distributors of construction equipment listed below have made changes in their cards appearing in the Distributors' Directory on pages 123 to 150 of this issue of CONTRACTORS AND ENGINEERS MONTHLY:

Edward R. Bacon Co., San Francisco, Calif.
Balzer Machinery Co., Portland, Oregon
Brown & Sites Co., Inc., New York, N. Y.
Bublitz Machinery Co., Kansas City, Mo.
Carolina Tractor & Equipment Co., Salisbury, N. C.
Choctaw Culvert & Machinery Co., Memphis, Tenn.
Concrete Machinery & Supply Co., Los Angeles, Calif.
Dravo Equipment Co., Pittsburgh, Pa.
The Earle Equipment Co., Detroit, Mich.
Evans Tractor & Equipment Co., Rapid City, S. D.
General Machinery Co., Spokane, Wash.
Gibbes Machinery Co., Columbia, S. C.
R. H. Hyland Co., Chicago, Ill.
Interstate Machinery & Supply Co., Omaha, Neb.
Kern-Limerick, Inc., Little Rock, Ark.
The G. F. Lowe Co., Chicago, Ill.
McQuade & Banning, Utica, N. Y.
James McGraw Co., Richmond, Va.
The K. B. Noble Co., Hartford, Conn.
Clare Osborn, Ltd., Montreal, Quebec
Henry A. Petter Supply Co., Paducah, Ky.
Raleigh Tractor & Equipment Co., Raleigh, N. C.
Howard W. Read Corp., Philadelphia, Pa.
J. Jacob Shannon & Co., Philadelphia, Pa.
Superior Supply Co., Chicago, Ill.
Swords Bros. Co., Rockford, Ill.
Syracuse Supply Co., Syracuse, N. Y.
The Robt. T. Twedt Co., Cheyenne, Wyo.
Western Material Co., Sioux Falls, S. D.



World's largest builder of starting, lighting and ignition equipment

Twenty years ago The Electric Auto-Lite Company was founded with a policy largely responsible for its phenomenal growth: *"To design, manufacture and service to the best of our ability starting, lighting and ignition equipment that will be a credit to us and a source of satisfaction to our customers."*

Today Auto-Lite builds more than half of all automotive electrical equipment. Back of Auto-Lite equipment stands . . . ample working capital . . . modern factories . . . a company operating its own foundries and manufacturing and insulating its own wire . . . a complete service station organization in every country on the globe . . . Also the same president, treasurer, secretary, vice-president of manufacturing, chief engineer, and service manager who started the company twenty years ago.

In twenty years of operation not a year has passed without substantial improvement in Auto-Lite equipment. That Auto-Lite has always built only the finest quality into electrical equipment is a good reason why gasoline and diesel engines, shovels, cranes, tractors, ditchers, dredgers, hoists, trucks, boats, compressors, fire apparatus, street sweepers, trenchers, locomotives and oil well drillers are some of the machines using Auto-Lite equipment for dependability. The Electric Auto-Lite Company, Toledo, Ohio.

Auto-Lite
Starting, Lighting & Ignition

Placing Concrete Through a Nozzle

THE application by hand of concrete as a plaster in constructing permanent fire-proof and weather-proof coatings is not possible economically.

The development of the Pneucrete gun by the Pneucrete Corp., Ltd., Long Beach, Calif., is another step in placing this type of work on a machine basis. The Pneucrete gun is designed to be fed with a premixed coarse sand and cement in a dry state and the delivery of this dry mixture through its various chambers by means of new type valves to a feed wheel mechanism at the bottom of the gun. This feed wheel measures the proper proportions of the dry mix in front of a constantly flowing supply of compressed air of from 35 to 60 pounds pressure in such a way that the dry material is carried in suspension in a steady uniform flow through a rubber-lined material hose to the nozzle and then to the place where it is to be used. The water is introduced only at the time the material passes through the nozzle. The concrete is shot from $\frac{3}{4}$ -inch to 4 inches thick at one operation.

The manufacturers claim that the hydration of the cement in transit through the Pneucrete gun and the core-breaker type nozzle produces a high compressive strength concrete. It is further claimed that the gun which is mounted on rubber-tired wheels and carries the hopper into which the sand and cement are fed is self-cleaning, saving about $1\frac{1}{2}$ hours per day.

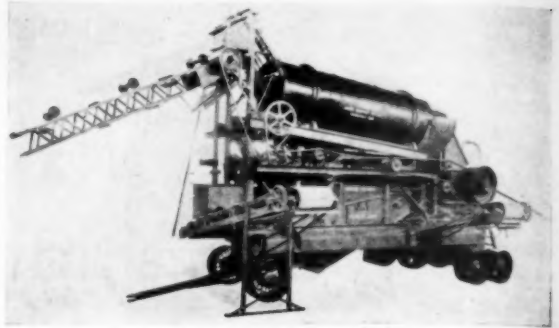


A Pneucrete Gun

A New Portable Gravel Washing Plant

A NEW portable screening, crushing, loading and washing plant has been tried out in various sections of the United States during the 1930 construction season and has shown considerable saving for the contractors who have used it on roadside materials. This plant is made by the Pioneer Gravel Equipment Manufacturing Co., 1515 Central Avenue, Minneapolis, Minn. The plant is equipped with a feeder belt conveyor leading up to the scrubber section of the 42-inch diameter screen. In this scrubber section of the shell around the revolving screen the materials receive their first wash. The oversize material is delivered into a Universal crusher and returned by means of a bucket elevator to the revolving screen.

The materials that have passed through the perforations of the revolving screen are classified on the SKF bearing-equipped shaker screen, situated directly underneath the revolving screen. The screen plate on the shaker is 15 feet long and 30 inches wide. Underneath the shaker screen is a dehydrator, a sand paddle arrangement which scoops the sand from the settling tank and delivers it to a delivery conveyor. The



A Pioneer 300-W Washing Plant

coarse aggregate is also delivered to a storage bin or stockpiles by means of a second delivery conveyor. The intermediate sizes of pea gravel may be sluiced away or may be saved if desired.

The entire plant is equipped with anti-friction bearings wherever the wear and stress seems to make roller bearings necessary. Steel cut and chilled sprockets are used throughout, and Diamond roller chains are standard on all important drives. The weight of the assembled unit is approximately 25 tons.

The three sets of Timken bearing-equipped wheels permit easy haulage of the entire unit by tractors. Athey truss crawler type wheels may be used instead of the two rear trucks if desired.

A New 14-S Mixer

A NEW 14-S mixer with the blades so arranged as to produce the same mixing action as in its larger mixers has been announced by the Ransome Concrete Machinery Co., Dunellen, N. J. For both the small and the large contractor desiring smaller units for special work, this model has shown itself efficient and economical.

The drum is made self-cleaning with large radius corners and with water clearances under the blades. The roller tracks are of high carbon steel and do not develop flat spots. The power loader bucket discharges its load cleanly and quickly into the drum. A batch hopper is provided, if desired. A round, two-piece discharge chute, the upper part of which swings entirely out of the drum during the mixing, increases the effective volume of the drum and saves wear.

The operator has complete control through the grouping of

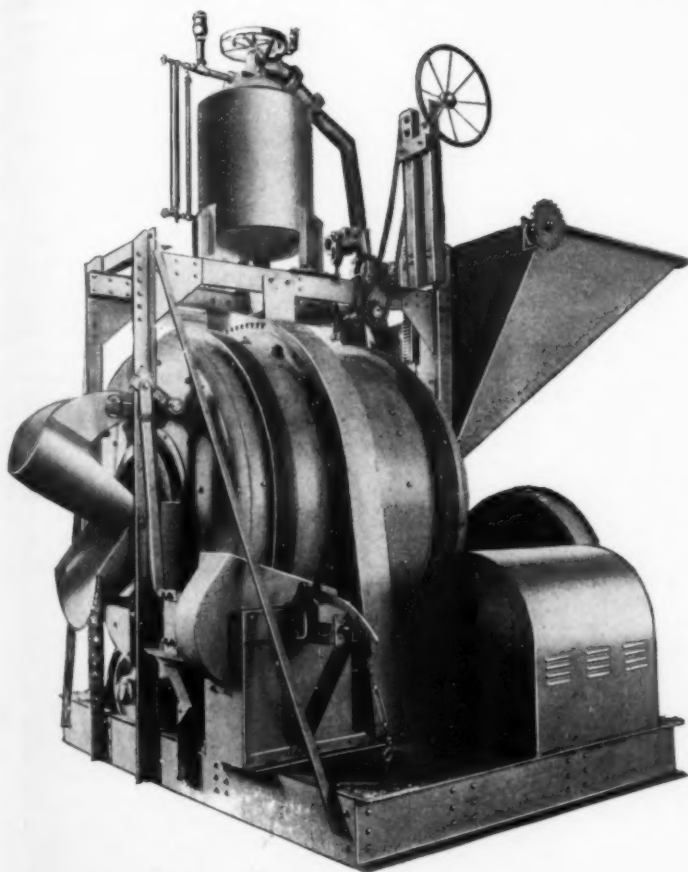


The New Ransome 14-S Mixer

Ransome 84-S

STANDARD BUILDING MIXERS

for Central Mixing Plants



"RANSOME is the Mixer for Central Mixing Plants"

Someone is pretty sure to say this when big operators of Central Mixing Plants meet together.

Ransome was the first to put out a three yard size and repeat orders are proving how well the Ransome 84-S does its job.

The following Central Mixing Plants, after using their first three-yard Ransome have purchased a second Ransome —

READY MIXED CONCRETE COMPANY
Pittsburgh, Pa.

SUPER CONCRETE CORPORATION
Washington, D. C.

GEORGE M. BREWSTER & SON, Inc.
Bogota, N. J.

N. RYAN COMPANY, Inc.
Brooklyn, N. Y.

GUARANTEED CONCRETE COMPANY
St. Paul, Minn.

Charles S. Warner Company,
Philadelphia, Pa. have recently ordered two 3-yard Ransomes for their plants.

Send for Bulletin #122 before you buy a mixer for a central mixing plant.

Ransome Concrete Machinery Company
Dunellen 1850—Service for 81 Years—1931 New Jersey

all control levers at the drum end. Automatic, accurate water supply is assured by the Ransome Spiral cut-off tank which is easily adjusted and gives quick discharge, quick cut-off and no dribble. The valves are non-bypassing. The drum rollers are of genuine car wheel metal, chilled and ground to an exact diameter. Each wheel runs on two Timken bearings and the roller shafts are of alloy steel.

The 14-S mixer is 10 feet 3 inches long overall, 9 feet 4 $\frac{3}{4}$ inches wide with the charging chute, 13 feet 3 inches wide with the power loader, and stands 7 feet 7 inches high without the power loader or tank. With the power loader it stands 10 feet $\frac{1}{2}$ inch high.



The New LaPlant-Choate Bull-Scoop

A Combination of Scoop and Bulldozer

A NEW combined piece of equipment for contractors known as the Bull-Scoop, formerly manufactured in the East, is now being made by LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa. These machines are particularly useful in cellar digging, shoulder finishing, corner changes and general work where excavating and short hauls are desired. It consists of a bulldozer carried in front of a Caterpillar Ten, Fifteen or Twenty tractor, and mounted on the same frame is a scoop which is carried at the rear. The shape of the bowl is such that it can be loaded with little drawbar pull, as the cutting edge is comparatively narrow, while the rear of the bowl has a flare which permits easy loading.

The Bull-Scoop is a one-man machine. Both the scoop and the bulldozer are entirely operated and controlled by the Caterpillar operator. The operation of the Bull-Scoop is automatic and no power take-off is used. A self-locking foot brake pedal, by which both the blade and scoop are regulated, is conveniently located for the operator and holds the blade and scoop in any position for continuous operation. A hand lever, placed conveniently at the side of the tractor operator, controls both the digging and hauling angle of the scoop, as well as the dumping of it. A hand wheel located directly in front of the tractor driver is used primarily for raising or lowering the bulldozer blade. This wheel wind is also used for lifting the bulldozer or the scoop from the ground when the tractor is not in motion and is disconnected when the scoop is being used.

The scoop will carry approximately 16 cubic feet of earth when mounted on a Caterpillar Ten, approximately 23 cubic feet on the Fifteen and approximately 30 cubic feet on the Twenty. The scoop is provided with four sharp heat-treated teeth which are designed to break up hard materials and force the earth up into the scoop. Sufficient leverage is afforded by the pitch of the teeth and the cutting edge to force the scoop down into the ground even when the surface is hard and small rocks and stubborn sod are encountered. The digging depth of the scoop is controlled by the foot brake and can be regulated so as to skim off the surface material or to dig in 9 or 10 inches. When the load is dumped the scoop

rotates a quarter of a turn, bringing the front end of the frame down, then by holding the brake, after the scoop swings into the normal position, it is held clear of the ground when returning empty for another load.

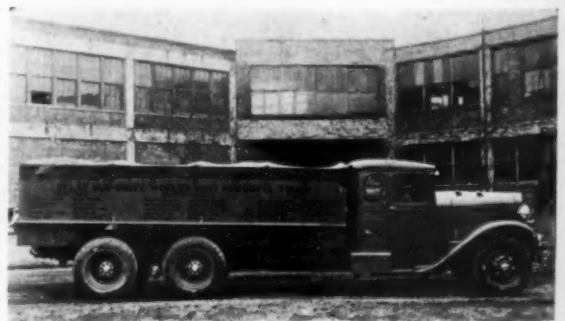
It is necessary to take the bulldozer blade off when the scoop is being used. It takes one man approximately five minutes to disconnect the blade. The bulldozer blade is controlled by the same brake as is used in controlling the scoop. In ordinary bulldozing work the blade and main frame are so balanced that after the brake has been released the blade lifts when backing up.

A Heavy-Duty Truck with Two Straight-Eight Engines

THE increasing use of heavy-duty motor trucks in building construction and excavating operations and in hauling heavy loads has been a factor in increasing the speed and efficiency of the construction industry. A new type of truck, introducing the multi-motor principle for the first time as a means of developing power, hauling capacity and speed, has been announced by the Relay Motors Corp., Lima, Ohio. This truck is a dual-engine, six-wheel, heavy-duty model. It has a capacity of 4 to 6 yards of wet mixed concrete or 5,000 to 10,000 bricks or tile in a single load.

The new truck is equipped with two straight eight-cylinder truck-type engines with a combined power of 275 brake horsepower at 2,800 rpm. The power is applied to the drive in a radically new way. Each engine delivers power to a separate Relay rear axle. This idea of having two separate rear driving axles is new in truck construction and overcomes many of the difficulties encountered in the operation of six-wheel trucks. The engines may be used in combination or one at a time. Each engine has its own transmission. An air mechanism shifts the twin transmission synchronously. This fool-proof feature eliminates the human element where the driver is concerned and insures the twin shiftings in exact mechanical harmony. One lever will shift both gears when both engines are in use. Two simple movements from the driver's seat connect or disconnect either engine.

This truck is equipped with heavy-duty air brakes with cast brake drum and molded brake blocks on all six wheels, and



The New Dual-Motor Heavy-Duty Truck

air connections for trailers. The manufacturers claim improved riding qualities, saving on tires, better distribution of the load through the use of the Relay axle, which suspends the load like a pendulum, allowing it to swing back and forth, reducing horizontal impact on all the rear wheels. Acceleration is rapid because of the dual engine. The balloon tires of 22-inch diameter are standard equipment on the new trucks. The driver's seat is adjustable with sleeping accommodations furnished for long hauls and ease in steering and operating the control. An hydraulic boosting mechanism on the steering apparatus eliminates steering strain and reduces fatigue.

TRUSCON STEEL LINER PLATES for Tunnels and Caissons



Truscon Steel Liner Plates in use. Note the spacious shaft due to the complete absence of shoring.



Construction of tunnels, subways, caissons and other underground work is speeded, simplified and safeguarded through the use of Truscon Steel Liner Plates. Many well-known, successful jobs testify to the practicability and economy of this method.

Truscon Steel Liner Plates are formed of individual segments curved to any desired radius, so that when assembled by bolting, a section of the tunnel or caisson is produced. The special design of the plates develops maximum strength and assures absolute uniformity.

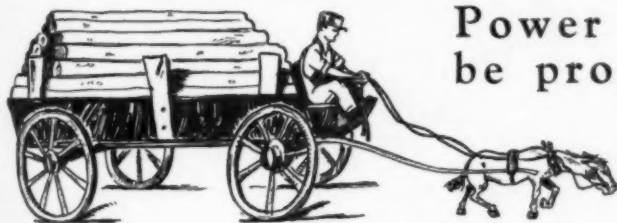
Two standard sizes are manufactured; the radius, gage of steel and depth of flange depending upon individual requirements. Holes in the flanges are spaced accurately to insure easy and rapid erection.

Caulking or gaskets are readily applied when air pressure is to be used in caisson work.

No complicated assembly is involved and no special tools are necessary. Shoring is eliminated and a considerable reduction in the excavating is made because of the narrow, rigid steel shell.

Suggestions, catalog and prices furnished without obligation

TRUSCON STEEL COMPANY
PRESSED STEEL DIVISION
CLEVELAND, OHIO



Power and Load should
be properly proportioned
whether for
hauling timber
or
Pumping Water

**"DOMESTIC" Pumps are properly proportioned
—both as to Power and Capacity Load**

THERE IS A "DOMESTIC" PUMP FOR EVERY NEED

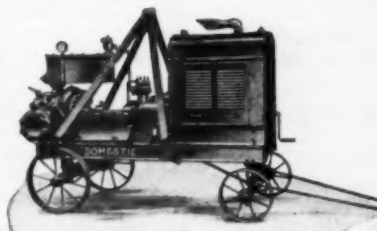


DOMESTIC DOUBLE
DOMESTIC DOUBLE.

For handling quickly, a large volume of water use "Domestic" Self-Priming Centrifugal Pumps.

For handling small quantities of water mixed with mud use "Domestic" Diaphragm Pumps.

For Water Supply requirements use "Domestic" Triplex Pumps.



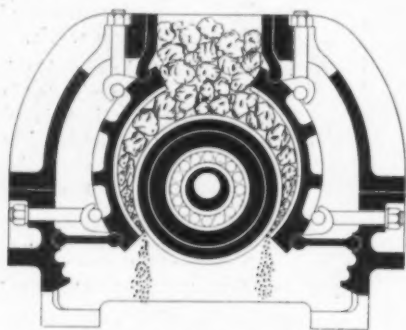
"DOMESTIC" SELF-PRIMING
CENTRIFUGAL PUMP

DOMESTIC ENGINE & PUMP CO., Manufacturers Shippensburg, Pa.
Distributors in all principal cities throughout the United States

A New Rock Crusher with One Moving Part

A NEW rock crusher designed for reduction or secondary work and built around an entirely new idea has been brought out by the James H. Beans Foundry Co., Martins Ferry, Ohio. The machine, which the manufacturers claim is quiet running and practically free from vibration, has but one moving part. It will be known to the trade as the Ohio crusher.

The frame as shown in the accompanying illustration is a heavy steel casting and supports the one moving part, an unusually heavy alloy steel eccentric shaft. The shaft rotates on Timken roller bearings, which are mounted in the sides of the frame and which are effectively protected against the entry of water and dust by positive oil seals. On the eccentric portion of the shaft a steel cylinder is mounted, also on Timken roller bearings, which has removable wearing plates of man-



The New Ohio Crusher

ganese steel. The cylinder does not revolve, but has a creeping action that insures uniform distribution of wear over its entire circumference. It oscillates in all directions between two curved manganese crushing plates, which are rigidly attached to the front and the rear of the frame. Adjustment for size and wear is obtained by moving the lower end of these plates in and out as required. The adjustment is positive, quick and easily made.

Material to be crushed is fed into the top of the machine directly on the oscillating cylinder. It then flows downward on both sides of the cylinder and is crushed between the cylinder and the two crushing plates. The crushing action is said to be true compression, that is, compression without a rubbing or abrasive action, thereby reducing wear on the crushing surfaces and minimizing the production of "fines."

The manufacturer now has two sizes of the Ohio crusher in production and others are to follow rapidly. The smaller machine weighs 8,750 pounds, has an opening $4\frac{1}{2}$ x 24 inches and a rated capacity, producing 1-inch material, of 30 to 40 tons per hour. The larger machine weighs 11,600 pounds, has an opening $4\frac{1}{2}$ x 36 inches and is rated at 50 to 60 tons per hour, producing 1-inch material.

New Type of Truck Speeds Unloading

WITH contractors interested in higher road speed and truck manufacturers giving serious consideration to this factor, the Griswold Powermatic Corp., Detroit, Michigan, has attacked the trucking problem from the angle of greater unloading speed to permit more time on the road. The Powermatic unit increases truck efficiency by reducing loading and unloading time. The unit operates directly from a conventional transmission power take-off without any necessity of the driver leaving his seat. It is capable of loading



Tilting the Powermatic Body Simplifies the Loading and Unloading of Machinery

5 tons and will unload 7 tons with ease. It is adaptable to all makes of trucks. Quick loading jacks at the rear of the truck frame relieve the truck axle of all unloading strains.

The Powermatic installation includes the power unit with gears running in oil, the long tool-steel worm carried on anti-friction thrust bearings, and the threaded cross head that actuates the body tilting mechanism. Large I-beams, carried on liberal sized rollers at the rear of the truck frame, take the place of the conventional body sills. To these I-beams the tilting mechanism is connected.

To operate the unit, a lever in the truck cab is moved to engage the power unit. The idling truck engine furnishes ample power for practically all loads. The body is moved slowly backward. As this movement continues, the rear edge of the truck body is lowered slowly to the ground while the front is elevated. As the load touches the ground or loading dock, the truck is slowly driven a short distance forward. By reversing this action, the loading of heavy or bulky machinery, crates, boxes, timbers, steel beams, etc., is facilitated. With the aid of a winch mounted at the forward end of the truck body the loading and unloading of heavy machinery is reduced to a one-man operation.

New Eight and Ten-Ton Industrial Locomotives With Five Speeds

TWO new models of McCormick-Deering-powered 8 and 10-ton industrial locomotives have been announced by the Brookville Locomotive Co., Brookville, Pa. These locomotives have five speeds and use a clutch manufactured by the International Harvester Co. In accordance with the policy followed in designing all Brookville locomotives, these standard units are installed in the chassis without alteration. As a result of this simple arrangement, the entire power plant and transmission, necessarily the most complicated parts of the locomotive, can be serviced at any one of the tractor



The New BMD 8-Ton Brookville Locomotive with 5 Speeds Forward and 5 Reverse

"I still don't know why we didn't hit him"



The narrow escape and the narrow road are close cousins. Once a community makes up its mind to act, it takes only a short time and a comparatively slight outlay to widen a road sufficiently to eliminate most of the accident hazard.

NINETY-horse-power cars—passing and repassing like gusts of wind—on narrow, old roads designed to accommodate the one-horse-power buggy. The wonder is that narrow escapes still are more common than smash-ups.

Tarvia is helping highway engineers to give their communities safer, broader roads. For Tarvia construction permits maximum width at minimum cost. A four-traffic-lane Tarvia highway often costs less than a two-lane pavement of the more expensive types of construction.

Yet the low-cost Tarvia road is a safe, smooth, non-skid highway. It is easy to maintain, and with moderate maintenance, will last indefinitely. Tarvia can be utilized with local materials to effect economies that bring traffic-safe roads within the reach of any community.

The Barrett Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
Buffalo	Columbus	Milwaukee
Providence	Syracuse	Cincinnati
Baltimore	Toledo	Rochester
Lebanon	Youngstown	Bethlehem
	Hartford	

In Canada:
THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Tarvia

GOOD ROADS
AT LOW COST

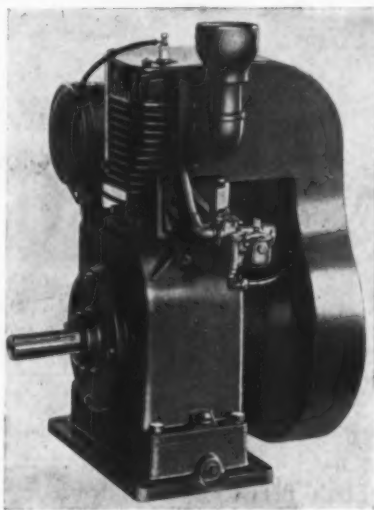
company branches.

The Brookville enclosed gear reverse is used on these models, making all five speeds of the standard International Harvester transmission available in either direction, providing an unusual number of speeds for an industrial locomotive. Speeds from 2 to 16 miles per hour are available for saving time on the run and the gears can be shifted while the load is under momentum.

For maximum traction the use of Brookville renewable steel tires is recommended. Steel tires provide 25 per cent greater traction and consequently 25 per cent greater pulling power than do ordinary chilled face drive wheels. Even though these steel tires be used, all Brookville locomotives are sufficiently powerful to slip all four wheels on a dry sanded rail. Similar to other Brookville locomotives, these two new models are equipped with dual spring journals and wide wheel faces in order to facilitate use upon rough and crooked tracks. They are available in any gage from 22 inches to 56½ inches or wider and are equipped with either four pocket link and pin type couplers or with MCB couplers for use with standard freight cars.

A New Line of Air-Cooled 1½ to 5-Horsepower Gas Engines

A LINE of air-cooled gasoline engines, ranging from 1½ to 5 horsepower, has been announced by the Wisconsin Motor Co., Milwaukee, Wis. Each size motor has a large hand hole plate removable for access to the connecting rod, oil pump assembly, etc. There are only two gears in the entire engine. The fan, flywheel, magneto, carburetor, cylinder head, etc., are completely enclosed in a metal hood, protecting all moving parts from dust, dirt and the weather.



One of the New Wisconsin Air-Cooled Motors Made in 1½ to 5-Horsepower Units

Particular attention has been paid to the balancing of the crankshaft and flywheel assembly, to give smoothness with a minimum of vibration. Timken roller bearings are used on both ends of the crankshaft to reduce friction and to make the motor easy to crank. The oil pump is driven from the cam. The air governor is on the inside of the engine hood, requiring little or no attention and no oiling or adjusting.

The cooling system on this unit is an induced draft created by a fan which is cast into the flywheel. The air flow is controlled by a housing which directs it against the cylinder and cylinder head to secure proper cooling. Ignition is through a flywheel type magneto of standard make. The rotation of the engine is clockwise when facing the flywheel of the engine.

These are especially adapted for running conveyors, concrete mixers, plaster mixers, saw rigs, pumps, compressors, generators and road machinery.

A Self-Oiling Sheave



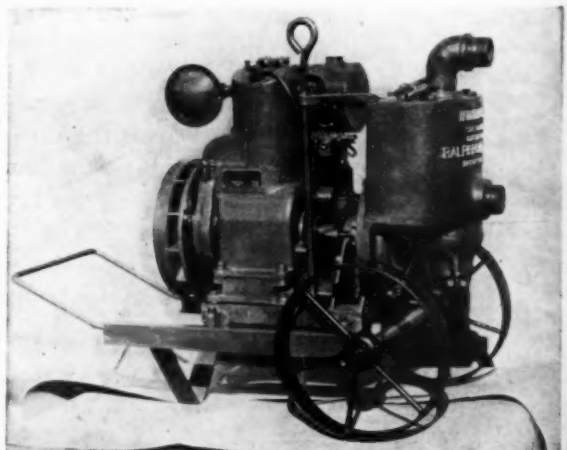
The Oil Reservoir Sheave with the Frame Removed

THE Ebel oil reservoir sheave, which has a steel hub with a 4-inch bronze bearing running in a 1½-inch diameter, hardened steel shaft, is the product of the Ebel Hoist & Pump Co., 324-26 S. Hosmer St., Lansing, Mich. The reservoir in this sheave holds one quart of oil. It has a felt washer for an oil retainer and has a bronze washer for side thrust. The frame is made of steel and has a large swivel eye. The cable flange is manganese steel and is a separate unit, riveted to the hub. All parts are replaceable. This sheave is built with materials which greatly lengthen the life of the sheave and the working parts are carefully fitted to eliminate wear and the loss of lubricant.

A Contractors' 2-Inch Self-Priming Pump

A 2-INCH centrifugal pump which is a new departure in the field of self-priming pumps has been announced by the Ralph B. Carter Co., 192 Atlantic St., Hackensack, New Jersey. Although this pump is easily handled on the job, dependability has not been sacrificed to secure extreme light weight. It has a heavy alloy non-clogging open impeller, oversized turned and ground shaft, a deep-stuffing box and a four-cycle air-cooled engine equipped with Timken bearings. It is built especially for centrifugal pump work. The absence of any complicated priming mechanism or manually-controlled levers or valves to operate delicate priming attachments, makes for simplicity and the fool-proof quality of a plain centrifugal pump.

The extreme overall dimensions of the pump on the standard outfit are 28 inches long, 11 inches wide and 25 inches high. The outfit will prime and reprime itself continuously and automatically on all suction lifts up to 28 feet, according to the guarantee of the manufacturer. The pump will deliver up to 7,500 gallons per hour, under certain conditions, while on the average job, capacities of approximately 6,000 gallons per hour are usual. This quantity is as large as can be handled practically through a 2-inch hose.



The New Humdinger 2-Inch Self-Priming Centrifugal Pump

A Veteran Driver Speaks His Mind

A letter to The Chicago Tribune, reproduced below, prompts this advertisement. Straight-forward, earnest and dramatic, the letter comes like a warning voice out of everyday traffic.



HAPPY IS THE DRIVER WHO DRIVES AN INTERNATIONAL

THIS letter, which is reprinted from the "Voice of the Traffic" column of The Chicago Tribune, sounds a note to which every owner of motor trucks and truck fleets should give heed.

Do your trucks deserve to haul your loads? Or are there antiquated models among them, hazardous to life and limb, destructive to driver-morale, and raising costly hob with your profit opportunities? Turn the obsolete trucks out to pasture and invest in efficient new equipment.

*There is a bright side to the veteran driver's letter. He admires the great modern fleet of Tribune trucks. This fleet, serving the Tribune organization, and used in the distribution of The Chicago Tribune, The New York Daily News, and Liberty, now numbers

over 200 trucks, and all of them are Internationals.

The full line of Internationals—Speed Trucks and Heavy-Duty Trucks of new design—is ready for inspection at 182 Company-owned branches in the United States and Canada. Sizes from $\frac{3}{4}$ -ton to 5-ton. Demonstration will be arranged at your request.



Above is one of the trucks this driver compliments so highly in his letter—it is one of The Chicago Tribune's large fleet of Internationals.

To the Chicago Tribune:

"I see that the Cook county police are beginning a drive against noisy trucks. Being a truck driver I believe that the authorities are taking the wrong course in warning drivers to make repairs.

The large cartage companies do not listen to the drivers' complaints, or else it is because our foremen do not inform the owners. Daily we are forced to take out patched up 10 and 15 and even 20-year old trucks, with faulty brakes, hard to shift, and still harder to steer.

As for loads, I have put a monster load of canned goods on one truck and hauled it through the city, praying all the time that no other vehicle would cut me off too close. Going at a speed of 10 miles an hour, I required 80 feet to stop, using both sets of brakes.

The speed governors on our trucks are all 'out of order,' and we are laid off if we do not make good time. It is the same if our chariots break down too often or if we have an accident, no matter how slight. It is only because we are expert drivers that we get by. I believe it really criminal to force men to drive some of the wrecks that are on the streets today.

*I notice (obviously, too) that the Tribune always has an up-to-date fleet of trucks, and I have yet to see one of them broken down on the street or in a serious accident."

A Truck Driver

INTERNATIONAL HARVESTER COMPANY

606 So. Michigan Ave.

OF AMERICA
(INCORPORATED)

Chicago, Illinois

INTERNATIONAL TRUCKS

A New Type of Gage for Testing Aggregates

WITH modern methods and under actual job conditions the strength of concrete is largely determined by the amount of mixing water used per sack of cement. As mixes are always based on dry aggregates and all have a certain percentage of moisture, it is necessary to determine the exact amount of water to use and so the moisture content of the aggregate must be ascertained and accounted for. An Aggregate Auto Gage has recently been announced by Toledo Precision Devices, Inc., a subsidiary of Toledo Scale Co., Toledo, Ohio, for this work.

With this scale, having once determined the moisture content of the regular run of each aggregate, one can automatically and correctly weigh out the specified amounts of the various aggregates, compensating for the surface moistures in each. Cement and water can be added by weight in the right proportions if desired.



The New Aggregate Auto Gage

The Toledo Aggregate Auto Gage will determine the specific gravity of concrete aggregate, it will determine the per cent of moisture of concrete aggregate, it will compensate for the surface moisture of concrete aggregate, it will show the exact weight of dry aggregate, it will indicate the weight of regular run aggregate, it will show the actual weight of surface moisture, it will make a sieve analysis, it will show the moisture within the aggregate themselves and it will do regular weighing.

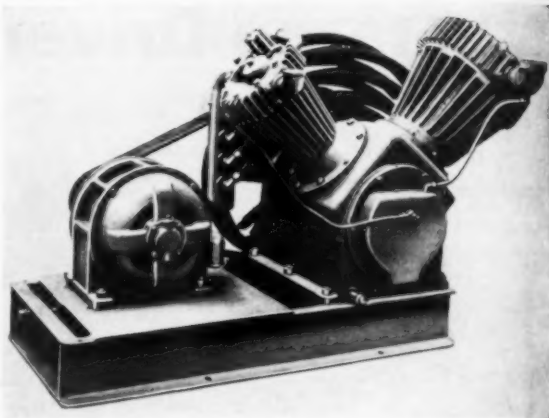
This device is designed primarily for production, laboratory and inspection work. It insures the correct water-cement ratio, a correct

proportion of cement to volume of concrete, uniformity of products, strength and durability. It reduces waste, reduces the total cost of material, facilitates handling and placing and simplifies the inspection and increases production volume.

A New 155-Cubic Foot Outdoor Air Compressor

A NEW two stage, air-cooled, electric-motor-driven air compressor that can be used in outdoor or exposed locations throughout the year without danger of freezing is a recent addition to the line of compressors made by the Ingersoll-Rand Co., 11 Broadway, New York City. This outfit is made in two styles, a direct-connected unit for installations that are fairly permanent, and a V-belt-driven unit for contractors and others who desire a semi-portable machine.

This compressor, type TLC, is particularly applicable to structural steel work and general contracting service, since it requires no water connections. The compressor and its driving motor are mounted on a single subbase, making a compact, self-contained unit that may readily be moved. A lifting bale can be attached to facilitate moving from floor to floor, or for handling on and off a truck.



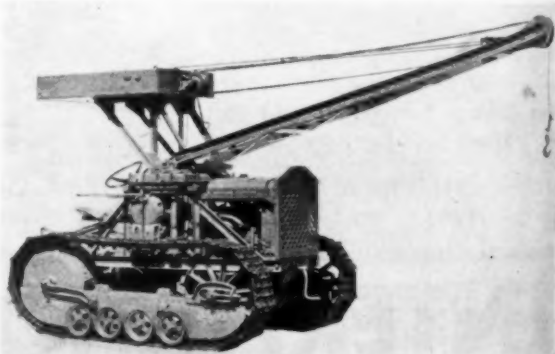
A New I-R Electric-Driven Outdoor Compressor

The compressor has a piston displacement of 155 cubic feet per minute and is designed for 100 pounds discharge pressure. It is delivered ready for use as soon as lubricating oil is supplied and power connections are made. Lubrication is automatic. Control is also automatic and the machine runs only when air is being used. Ball bearings are used on both the motor and compressor and require no adjustment. An air-sealed unloader protects the motor by unloading both cylinders and intercooler whenever the compressor stops.

Tractor Crane Does Work of Ten Men

A COMBINATION tractor-mounted crane which provides a compact, sensible and easily operated unit meeting the needs of contractors for spotting, lifting and transporting heavy weights, is to be found in the Roustabout crane manufactured by the Hughes-Keenan Co., Mansfield, Ohio, and mounted on a Model GU Allis-Chalmers industrial tractor equipped with Trackson crawlers. There are many uses for this equipment in the contracting, highway and general construction fields. It is used for laying pipe, setting poles, removing cofferdam forms, loading and unloading supplies and machinery, lifting sheet metal, concrete slabs, etc., and it may also be used with a light clamshell for handling building materials of various kinds.

The portability of this tractor-crane is a particular advantage, for it makes it possible for the crane to go wherever it is needed on a job. It will replace as many as eight or ten men and eliminates the danger of accidents, which are apt to happen when heavy lifting and moving is done by hand labor.

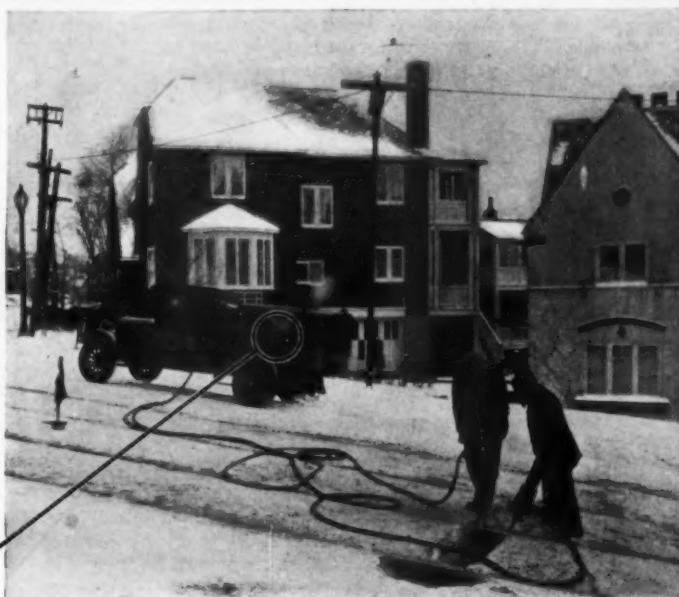


The Hughes-Keenan Roustabout Crane

... and it was **FREEZING COLD**

But why waste valuable hours starting the compressor just because it is cold. With a "SCHRAMM" on the job, it's an easy task to crank the engine ONLY, let it warm up for a few minutes and then throw on the full compressor load—all set for a big day's work. "SCHRAMM" HAS A CLUTCH.

Here is the distinctive "SCHRAMM" clutch. It permits starting engine without compressor load.



A No. 120 truck-mounted SCHRAMM compressor operating two paving breakers for the Montreal Tramways Co. at Westmount, a suburb of Montreal . . . and it was cold.

There are other features—ask for the catalog.

SCHRAMM, INC.

West Chester, Pa.

Stocks and Service in All Principal Cities

BETTER THAN EVER

A SUPER OIL, TAR and ASPHALT DISTRIBUTOR

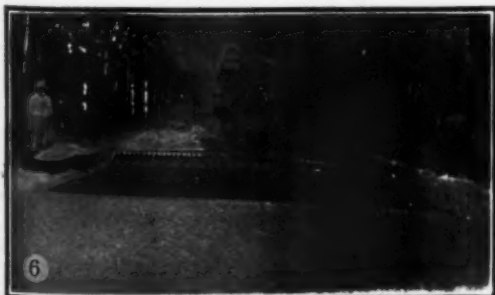
— for  1931 —

That is what

STATE OFFICIALS, COUNTY OFFICIALS and CONTRACTORS
will find embodied in the 1931

“ETNYRE MODEL F”

Designed and built to maintain and produce the best kind of BITUMINOUS ROADS by applying the material in just the right amount at the proper temperature.



This is an actual photograph of an "ETNYRE MODEL F" applying 7/10 gallons per square yard, asphalt heated to 340 degrees F. with 18' spray bars on the Sanford-Orlando Road No. 3 in Florida. This is a splendid example of

"ETNYRE FULL WIDTH DISTRIBUTION"

The first application of 2 gallons per square yard was also applied with 18' spray bars.

Let us send you bulletin No. 503 giving specifications and more interesting facts.

Manufactured by

E. D. ETNYRE & COMPANY

Oregon, Illinois

SALES OFFICES IN PRINCIPAL CITIES

The boom of the Hughes-Keenan crane is full-revolving, swinging in all directions through a complete circle, on a ball-bearing turntable. The boom can be raised and lowered by power, so that the unit may go through doorways, and the load can also be raised or lowered without moving the boom. The load is shifted by a cable which is wrapped on a drum and which is independent of the cables that hold the boom in place. The crane does not interfere with the use of the crawler tractor for drawbar work, and therefore the outfit is an all-purpose unit which may be used for hauling dirt in trailers, scrapers, or wagons, pulling big trucks through mud, sand, etc., and many other jobs as well as for crane work.

A New 12-Cubic Yard Drag-Scraper

DURING the last few years drag-scrappers have been built in larger and larger sizes, particularly for the larger unit capacities required in the levee building tower machines for Mississippi River levee construction. Recently Sauerman Bros., Inc., 464 South Clinton St., Chicago, Ill., have built several Crescent drag-scrappers of 12 cubic yards capacity exceeding by two yards the largest buckets previously built. One of these large scrapers, standing almost 6 feet high and measuring 11 feet across, is shown in the accompanying illustration.



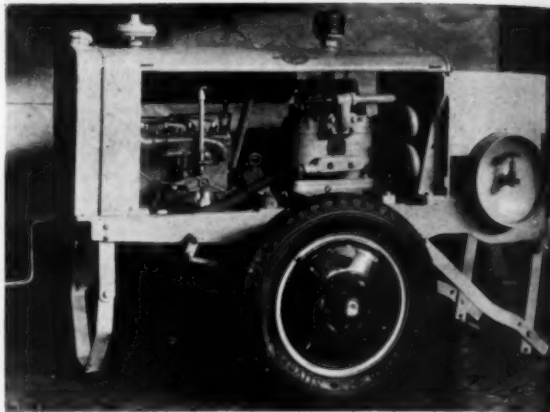
The New Sauerman 12-Cubic Yard Drag-Scraper

This 12-cubic yard bucket brings in a load of 16 to 17 tons of earth at a time, and the bucket itself, equipped with chains and teeth weighs only 5½ tons. This feature of light weight in proportion to capacity is an advantage due to the plowshare design and curved plate construction of this type of bucket. Other advantages claimed for it are easy and uniform digging with a minimum of power and easy and clean dumping. Sauerman drag-scrappers are now built in sizes from ¼-yard to the machine described above.

Details of Portable Compressor Construction

PARTICULAR attention has been paid to refinements in the Curtis 80, 120, 180 and 240-cubic foot portable air compressors mounted on four rubber-tired wheels. These units are made by the Curtis Pneumatic Machinery Co., 1671 Kienlen Ave., St. Louis, Mo. In order to insure the compression of as cool air as possible, the intake is located above the machine rather than under the hood. The after-cooler is located between the compressor and the tank, giving a drop in air temperature from 450 degrees to 240 degrees coming out of the tank, which greatly lengthens the life of the air hose.

Another item which is of importance is that both the fuel



This Curtis Trailer Compressor Unit Has All the Features of the Larger 4-Wheel Mounted Machines

tank and the air tank are carried on a separate steel frame to eliminate vibration and thus prevent radiator troubles.

The compressor valves are of the light disc type, double heat treated and made of rust-resisting metal. The whole valve unit assembly for a cylinder can be easily removed by simply unscrewing four nuts. The design is such that valves can be removed after long service and from a hot compressor without sticking or delay. Also, the whole head of the piston is exposed for inspection when the valve assembly is removed. The small individual non-warping valves each has single large non-obstructed ports and are carbon-free.

The Climax engine on a standard 3-point support and the compressor are mounted on a cast steel frame for rigidity. The frame has side openings, making the compressor oil system and the connecting rods easily accessible.

New Drills for Tunneling

ANNOUNCEMENT of three new drifters for tunneling work and also for heavy down-hole drilling from tripods or quarry bars in channeling or line drillings, has been made by the Sullivan Machinery Co., 814 Wrigley Bldg., Chicago, Ill. These drills include the T-7, having a 3-inch cylinder and weighing 122 pounds for holes to 15 feet deep, the T-6 with a 3½-inch cylinder, weighing 159 pounds for holes to 20 feet deep and the T-5, with a 4-inch cylinder, weighing 190 pounds for holes 30 feet or more in depth.

The important features of these new drifters which are uniform in design, include a smooth outline and absence of projections, securing maximum convenience in drilling top and bottom holes from a column arm or bar and in handling steel over the drill. The new chuck design for shankless or lugged steel is of great ruggedness and simplicity. The water inlet is at the side or rear of the backhead as preferred. The hole blower has an independent control. The shell trunnion is either offset at the front or centrally located. The drills are said to have a smooth running balance, are easy and convenient to handle and have a notable increase in drilling power and speed. In addition to use as a mounted drill, the two smaller sizes, T-6 and T-7, may be equipped with a spring-mounted handle in place of the shell which enables them to be used as heavy-duty sinking drills without undue fatigue on the part of the operator.

The interchangeability of services of these hammer drills makes these tools effective aids in rock excavation.



The T-7 Drifter

SURE—FOOTED TRACTION



Moon Track-equipped tractors take full loads all the way—Four-point ground contact provides sure-footed going in all soils—Whether uphill, downhill or sidehill, Moon Tracks are in FULL contact with the ground—Mud, sand or gravel are negotiated the same as hard surfaces—Add positive traction to the tractor of your choice—McCormick-Deering, Allis-Chalmers or Case.

Moon Track-equipped tractors hug the ground, providing traction and full drawbar pull all the time. Tractor drivers appreciate the smooth travel of these tractors.

MOON TRACK COMPANY

1822 McCormick Bldg.

CHICAGO

Dept. C. E.

ILLINOIS



Any of 4 FINISHING COMBINATIONS in ANY LAKEWOOD Type "C" FINISHER

Every Lakewood Type "C," whether new or now operating, offers choice of any combination, equips you for maximum service. For fast, steady production on concrete and bituminous pavements, city streets and highways, use a Lakewood. Send for Catalog. CE

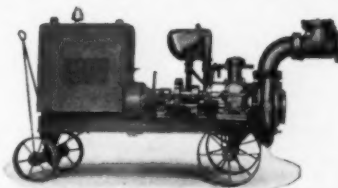
Also Subgraders, Grade Rooters, Road Forms (with or without Duo Rail attachment), Batch Boxes, Straight Edges, Hand Belts, Subgrade Testers.

THE LAKEWOOD ENGINEERING CO.

231 Dublin Ave., Columbus, Ohio, U. S. A.

CONTRACTORS...

Here's Your Pump Automatic Priming Centrifugal Pumping Unit



It is a LAWRENCE "VORTEX"

Ever-Ready to Pump Big Volume or Small
No Priming—No Foot Valves

High vacuum or Suction lift—27 feet max.
Ideal for dewatering excavations of all kinds, cofferdams, sewer-trenches, quarry pumping, wellpoint systems, etc.

Built in five sizes for any job—large or small—with gasoline engine or electric motor.

Write for Bulletin D-24

LAWRENCE PUMP & ENGINE CO.

P. O. Box 70, LAWRENCE, MASS.

NEW YORK OFFICE, 90 West Street

These especially selected catalogs and pamphlets of value to contractors are for free distribution. You will find it worth while to check these lists each month and write for the catalogs you need.

SEND FOR THIS FREE LITERATURE

A Practical Combination of Scoop and Bulldozer

Folder No. 16, issued by the LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, describes its Bull-Scoop for mounting on Caterpillar Ten, Fifteen or Twenty tractors and which permits either bulldozing or handling of from 16 to 30 cubic feet of earth on short hauls in the scoop.

A New Diesel Shovel

A catalog describing the new 2¼-yard 52-B diesel shovel-dragline-clamshell-crane, among the features of which are a 6-cylinder slow speed Atlas-Imperial full-diesel engine, improved steering, oversize mountings, may be secured by those interested from Bucyrus-Erie Co., South Milwaukee, Wis.

Converting Beam Scales to Automatic Scales

The Howe Scale Co., Rutland, Vt., has issued an interesting booklet covering the Weightograph which is claimed as the most modern automatic indicator instrument. This can be attached to any type of beam operated scale from the dormant warehouse type to the railroad track scale. When so attached it converts the beam to an automatic scale.

An All-Purpose Light Weight Full-Revolution Crane

The Hughes-Keenan Roustabout crane, made by the Hughes-Keenan Co., Mansfield, Ohio, and mounted on a Model GU Allis-Chalmers industrial tractor with Trackson crawlers, is an all-purpose full-revolving unit of interest and value to contractors. Complete information may be secured direct from the manufacturer.

A Quadruplex Self-Oiling Road Pump

A new high pressure road pumping unit, consisting of a vertical quadruplex enclosed self-oiling pump with a capacity of 86 gallons per minute against 500 pounds pressure, has been announced by the Sterling Machinery Corp., 2303 Holmes St., Kansas City, Mo., who will be pleased to send a complete description on request.

A New Convertible Power Shovel

The Keystone Driller Co., Beaver Falls, Pa., will be pleased to send complete data and prices on its new convertible power shovel which is full-revolving and full-crawler mounted and is equipped with all standard excavating buckets and attachments.

New Drills for Tunneling

Three new drifters for tunnel work and also for heavy down hole drilling from tripods or quarry bars in channelling or line drillings, and which are made in three sizes for holes 15, 20 and 30 feet or more in depth, respectively, have been announced by the Sullivan Machinery Co., 814 Wrigley Building, Chicago, Ill., and are described in Bulletin 87-F.

A Finisher for Asphalt Pavement Construction

Bulletin No. 1213, a well-illustrated booklet describing the Ord finisher for use in asphalt pavement construction, and which can with minor modifications be used for concrete paving, may be secured by those interested from Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Penna.

Road Building Equipment

Catalogs describing Koehring pavers and shovels, Insley shovels, Smith pavers, and C H & E road pumps may be secured by interested contractors from the National Equipment Corp., 30th St. and Concordia Ave., Milwaukee, Wis.

A Complete Line of Paving Equipment

Bulletins describing the Lakewood paving and construction equipment, including finishing machines, subgraders, road forms, grade-rotters, straight-edges, batch boxes, concrete mixers, towers, chuting equipment, concrete carts, buckets, bin gates and similar equipment, may be secured from the Lakewood Engineering Co., 231 Dublin Ave., Columbus, Ohio.

Chimneys Designed, Built or Repaired

The Northwestern Chimney Construction Co., Fidelity Bldg., Cleveland, Ohio, will be glad to send to those interested information in regard to its service for the design and construction of radial brick chimneys and the inspection and repair of old chimneys while in operation.

Steel Sheet Piling

New and used steel sheet piling for foundation, cofferdam and sewer work is sold, bought or rented by B. W. Lindheimer, Inc., 38 South Dearborn St., Chicago, Ill. Complete information will be sent on request.

Reinforced Concrete Pipe

Newark Concrete Pipe Co., 323 Broadway, Newark, N. J., will be glad to send to those interested, complete information in regard to Newark reinforced concrete pipe which is easily laid at small expense with a perfect flow line.

Road Rollers from 5 to 14 Tons

The new Huber catalog describing the complete line of Huber road rollers which are rugged, fast, powerful, dependable, flexible, safe and practical, will be sent on request by the Huber Manufacturing Co., 330 East Center St., Marion, Ohio.

To Excavate in the Dry Use Wellpoints

The Moretrench Wellpoint System of lowering the water level in excavations to permit work in the dry is completely described in the new catalog of the Moretrench Corp., (successors to Moore Trench Machine Co.), 90 West Street, New York.

Operating Trucks Profitably in Contracting

A valuable discussion of this important subject has been prepared by General Motors Truck Co., Pontiac, Mich., based on a nation-wide survey of truck operation in contracting. This impartial and authoritative treatise on truck operation is available without cost to contractors who will write direct to the company requesting a copy of the report.

Portable Engine-Driven Air Compressors

Publication No. B-870, containing a complete description of the National Type WN compound portable engine-driven air compressors, including illustrations and complete specifications for each size, may be secured by those interested from the National Brake & Electric Co., Milwaukee, Wis.

Dependable Expansion Joints

Data and prices on Carey Elastite expansion joints, the felt side joints of which give dependable service to road builders may be secured by interested contractors by writing to the Philip Carey Co., Lockland, Cincinnati, Ohio.

Road Equipment for Contractors

Literature describing Wiard contractors' plows, automatic revolving scrapers, a three-in-one tool for excavating, grading and spreading, Wiard grade-rippers, a scarifier or gang roofer, will be sent to those interested on request by the Wiard Plow Co., Batavia, N. Y.

An Improved Extra-Capacity Trailer

G. H. Williams Co., 609 Haybarger Lane, Erie, Penna., will be glad to send to those interested literature describing the Williams improved extra-capacity trailer, among the features of which are heavy arch-girded front end members, free-swiveling frames, low rear loading, easy turning fifth wheel, Alenite lubrication, heavier main members for the side frame and positive bearing adjustment.

Forms for All Types of Concrete Construction

Metaforms for use in all types of construction where concrete is poured and which are easy to place, economical and efficient are described in literature which Metal Forms Corp., Milwaukee, Wis., will be very glad to send to those interested.

Are Welding Supplies

This is the title of a booklet describing the complete line of Lincoln welding accessories, including Fleetweld, Stable-arc welding rod, various electrodes and anodes, shields, holders, cables, autogenizers and clothing, and may be secured by those interested from the Lincoln Electric Co., Cleveland, Ohio.

A New Mechanical Spreader

Literature describing the new Goroco mechanical spreader which is attachable to any make of truck, is interchangeable between trucks in one minute and spreads any width from 4 to 20 feet, will be sent on request by the Goroco Mechanical Spreader Co., Upper Darby P. O., Philadelphia, Penna.

An Efficient and Easily Convertible Digging Tool

The Ohio excavator, which is a modern and flexible machine, rated at ¾-cubic yard capacity and designed to operate as a shovel, crane, pull-shovel, clamshell, dragline and backfiller without the addition of any complicated mechanism, is described in literature which the Ohio Locomotive Crane Co., Bucyrus, Ohio, will be glad to send on request.

Hot Galvanized Guard Posts

Truscon all-steel hot galvanized guard posts for highways which have many distinctive and protective features for the installation itself and for motor traffic are described and illustrated in Bulletin 513 issued by the Truscon Steel Co., Youngstown, Ohio.

V-Belt Drives for Power Transmission

The Falls Clutch & Machinery Co., Cuyahoga Falls, Ohio, has issued an interesting illustrated booklet describing Falls V-belt drives which reduce maintenance and operating costs, as they are made of rubber and cord, absorb vibration, run smoothly and do not cause rattle because of wear.

Iron Pipe Railings

Pipe Railing Construction Co., Fifth St., Long Island City, N. Y., will be glad to send to those interested complete information in regard to its iron pipe railing for stairs, bridges or retaining walls.

Super-Charger Feature of Air Compressor

Complete information in regard to the Thor Six air compressor which is equipped with a Super-Charger designed to counteract the various losses of air in order that the compressor may deliver more air and therefore cut operating costs, may be secured from the Independent Pneumatic Tool Co., 248 So. Jefferson St., Chicago, Ill.

Don't Overlook a Bet—

Last year some city and county officials and contractors, too, bought light, thin sheet-steel

Tar and Asphalt Kettles

when they could have Chausse boiler-plate kettles for the same price. Chausse kettles outlast 2 to 3 light ones. It pays to use them. Made in 1, 2, 3 and 6-barrel sizes. Hand spray pumps, warming hoods, barrel hoists can be furnished.



Other products—Street Repair Plants, Surface Heaters, Fire Wagons, Concrete Mixer Heaters, Kerosene Torches, Write for illustrated catalogs.

Chausse Oil Burner Company
Elkhart Indiana

ONE-MAN **Schaefer** CLEVELAND AUTOMATIC

Tractor Scraper



It will pay you to investigate this outstanding Tractor Scraper. Write for circulars today.

Nearly ten thousand in use, the world over for developing roads, parks, cemeteries, golf and airplane landing fields, digging cellars, grading around new schools, laying out allotments filling trenches, etc.

This good earth moving tool is

Labor-saving (one-man operated)

Handy and easy to run (loading and dumping, spreading and leveling, are all handled from the driver's seat—and there's nothing to regulate, oil or adjust)

Low in upkeep cost (wearing parts are few and easy to replace)

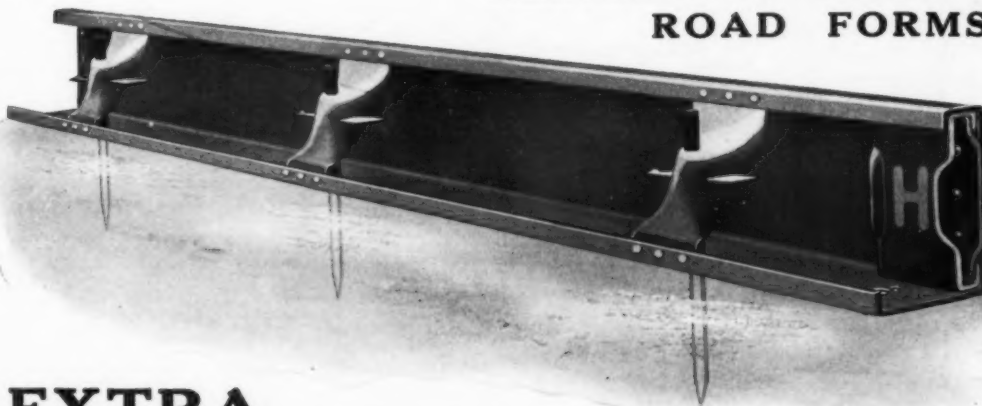
Four sizes: scraper widths, 4, 5, 6, 7 feet

The Gustav Schaefer Company

4180 LORAIN AVENUE

CLEVELAND, OHIO

HELTZEL SUPERIOR LOCK ROAD FORMS



EXTRA LONG LIFE—NO EXTRA COST

Heltzel Superior Lock Road Forms are reinforced with an extra flange on the base and by the use of a 2½-inch wide tread. Further, the bridging action of the stake-pocket construction gives an additional diagonal bracing.

The extra durability built into Heltzel Super-

rior Lock Road Forms is a real premium, yet you are not required to pay any extra price for Heltzel Superior Lock Road Forms.

By all means, investigate this economical Form for your next job!

THE HELTZEL STEEL FORM & IRON CO.,

WARREN OHIO

Shovels for All Jobs

Osgood Co., Marion, Ohio, will be glad to send to those interested, complete information in regard to its Osgood shovels which offer service, efficiency and dependability on all kinds of excavating jobs.

Bridge Planking

Serviceed bridge planking which is self-healing, slow-wearing, noise-deadening, waterproof, resilient, non-slip and quickly laid, is described in literature which the Serviceed Premoulded Products, Inc., 53 West Jackson Blvd., Chicago, Ill., will be glad to send on request.

A Cost-Cutting Pipe Cutter

A circular describing the Ellis pipe cutter, which has six keen rotary blades which cut their way through any pipe from 4 to 12 inches in diameter, and which cuts costs as well as pipe, may be secured from the Ellis & Ford Mfg. Co., 32 Piquette Ave., Detroit, Mich.

A One-Man Tractor Scraper

The Schaefer one-man tractor scraper which is sturdy, economical and labor-saving and is made in four scraper widths of 4, 5, 6, and 7 feet, is described in literature which the Gustav Schaefer Co., 4180 Lorain Ave., Cleveland, Ohio, will be glad to send on request.

A Portable Self-Priming Centrifugal Pump

Homelite Corp., 71 Riverdale Ave., Port Chester, N. Y., will be glad to send to those interested a complete description of the Homelite portable self-priming centrifugal pump which weighs 90 pounds, has a capacity of one gallon of seepage to 7,500-gallon volume per hour, is self-contained and equipped with a built-in Homelite air-cooled gasoline engine.

Derricks and Winches

Information in regard to the complete line of Sasgen derricks and winches for material handling may be secured by those interested from the Sasgen Derrick Co., 3101 Grand Ave., Chicago, Ill.

Heavy-Duty Trucks

Dodge Bros. Corp., Detroit, Mich., will be glad to send to those interested complete information in regard to Dodge heavy-duty trucks which are dependable, ranging in payload capacities from 3,600 to 11,175 pounds and are equipped with a powerful 96-horsepower engine.

Asphalts for Road Work

Complete information in regard to Standard asphalt binder A for surface treatment, Binder B for penetration work, Binder C for the mixing method, asphalt joint fillers, cold patch asphalt for repairing all types of bituminous road surfaces, refined asphalt for sheet asphalt paving, and other Standard products may be secured from the Standard Oil Co. of New York, 26 Broadway, New York City.

Pumps for All Types of Construction Work

Descriptive bulletins containing complete information in regard to Domestic pumps for excavation, sewer, pipe line or bridge work, which are made in sizes and types for all conditions encountered by contractors, may be secured from the Domestic Engine & Pump Co., Shippenburg, Penna.

Vertical and Underbody Hydraulic Hoists

St. Paul Hydraulic Hoist & Body Co., St. Paul, Minn., will be glad to send to those interested complete information in regard to its line of St. Paul vertical and hydraulic hoists for dump bodies, which give speed, dependability and efficient service.

Electric Starters and Generators

Complete information in regard to Auto-Lite electric starters and generators for construction equipment, the use of which reduces operating costs and speeds up operations, will be sent on request by the Electric Auto-Lite Co., Toledo, Ohio.

High-Early-Strength Concrete

A booklet, "High-Early-Strength for Roads, Streets and Bridges" describing Universal Atlas cement and methods for securing high-early-strength concrete may be secured by interested contractors from the Universal Atlas Cement Co., 210 So. LaSalle St., Chicago, Ill.

A New Tractor Shovel

Bulletin No. 251 describing the new Trackson High Shovel which does its own spreading and bulldozing, takes a full half-yard bite in any soil or bulk material and may be equipped with wheels or Trackson crawlers, will be sent on request by the Trackson Co., 1323 So. First St., Milwaukee, Wis.

Simplified Concrete Curing

Interesting booklets describing a simplified method of curing concrete by spreading calcium chloride immediately after the removal of the wet burlap, may be secured by those interested from the Columbia Products Co., Barborton, Ohio, the Dow Chemical Co., Midland, Mich., or the Solvay Sales Corp., 61 Broadway, New York City.

Oil-Burning Tar and Asphalt Heaters

Connery & Co., Inc., 4000 N. Second St., Philadelphia, Penna., will be glad to send to those interested a complete description of its Style J oil-burning tar and asphalt kettle for highway maintenance work, which may be obtained in five sizes, 60, 85, 110, 165 and 200 gallons capacities.

Dependable Road Torches

The Toledo road torch, which is dependable, instantly recognized as a warning signal, and burns in any kind of weather is described in literature which the Toledo Pressed Steel Co., Toledo, Ohio, will be glad to send on request.

Data on Culvert Durability

Armco Culvert Manufacturers Assn., Middletown, Ohio, will be glad to send to those interested authoritative data on culvert durability and on the planning of drainage on new roads as well as a complete description of Armco ingot iron culverts and drains.

A New Rock Crusher

Complete information in regard to the new No. 14 Climax crusher, which has a cast steel frame, jaw dimensions of 14 x 28 inches and a number of improved features, may be secured by those interested from the Good Roads Machinery Co., Kennett Square, Penna.

Dumping Equipment

Complete information in regard to the line of Wood dumping equipment, including hoists and dump bodies for chassis of 3 tons and up, for 1½ to 3-ton chassis and for 1 and 2½-ton chassis, may be secured by those interested from the Wood Hydraulic Hoist & Body Co., Detroit, Mich.

A New Pocket Catalog on Wire Rope

The new Williamsport 1931 pocket catalog and data book, containing much valuable information for wire rope users, will be sent, on request, to those interested, by the Williamsport Wire Rope Co., Williamsport, Penna.

A Complete Line of Industrial Power Units

Complete information in regard to the Cletrac line, ranging from the 15-horsepower small Cletrac to the maximum delivery of 80 horsepower in the big 80-60, to meet every power need in outdoor work, may be secured from the Cleveland Tractor Co., 19321 Euclid Ave., Cleveland, Ohio.

New Dial-Scale Weigh-Hopper for Bucket Loader

Information regarding a new dial-scale weigh-hopper that will weigh within 0.4 of 1 per cent which makes it adaptable for concrete batching may be secured from the Barber-Greene Co., 465 W. Park Ave., Aurora, Ill. This weigh-hopper is used with the new Model-62 Super bucket loader, a crawler-mounted self-feeding one-man-operated machine with a capacity of 62 cubic feet per minute.

A Dual Engine Six-Wheel Heavy-Duty Truck

Relay Motors Corp., Lima, Ohio, will be pleased to furnish complete information regarding its new multi-motor truck driven by two straight 8-cylinder truck-type engines through the four rear wheels. This truck is capable of handling 4 to 6 yards of wet mixed concrete or 5,000 to 10,000 bricks or tiles in a single load.

A New Enclosed Self-Oiled Industrial Power Unit

Hercules Products, Inc., Evansville, Ind., has announced new 2 and 3½-horsepower engines which are completely enclosed and self-oiling, making them suitable for use under any climatic conditions and eliminating the lubrication problem.

A Device for Boring Under Highways and Streets

The Hydranger Corp., Ltd., 1298 Bryant Street, San Francisco, Calif., will be pleased to send a copy of its folder describing the Hydranger, a new tool for boring under streets, highways, sidewalks, buildings, gardens, to lay pipe, conduits, drains and sewers, avoiding pavement cutting almost entirely.

A New Elevating Grader

Bulletin W-31-B, describing the new Western No. 6 elevating grader, among the features of which are a 10-inch steel tube backbone, no waste of tractor power, a capacity of 300 cubic yards per hour, a new control for the plow and a motor-driven belt carrier, may be secured by those interested from the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, Ill.

Operating Manual for Gasoline Motors

A 36-page operating manual for Briggs & Stratton Model M gasoline motor, including such material as how to start the motor for the first time, what to do when the motor will not start, a trouble remedy chart, the construction and maintenance of the motor, how to order parts, motor specifications and similar information, may be secured by writing to Briggs & Stratton Corp., Milwaukee, Wis.

A Complete Line of Construction Equipment

Heltzel Steel Form & Iron Co., Warren, Ohio, will be glad to send to those interested Catalog No. 30, describing its complete line of construction equipment including volumetric and weighing Agrabatchers, portable steel bins, batching plants, forms of all types, trail graders, subgrade testers, automatic strike-offs, bridges, straight-edges, hand floats and similar equipment.

Pipe Bending

This is the title of a booklet describing the principles and practice of bending Byers genuine wrought iron pipe and may be secured from the A. M. Byers Co., Clarke Building, Pittsburgh, Penna.

All-Steel Bodies and Hydraulic Hoists

Literature describing the Galion all-steel bodies and Galion hydraulic hoists for mounting on trucks may be secured by interested contractors from the Galion Allsteel Body Co., Galion, Ohio.

Concrete Facts

This is the title of a 24-page booklet describing and illustrating the Paris Transit mixer, which consists of a revolving mixing drum to be mounted on a truck, deriving the power for rotating and tilting the drum from the truck motor. Copies of this booklet may be secured by those interested from Transit Mixers, Inc., Call Bldg., San Francisco, Calif.

A Portable Washing Plant

The Pioneer Gravel Equipment Manufacturing Co., 1515 Central Ave., Minneapolis, Minn., will be glad to send to those interested literature describing the new 1931 model of the Pioneer washing, screening, crushing and loading plant, a portable single unit plant for producing washed crushed gravel and sand.

Wheeled Scoops for Dirt Moving

Bulletin 3102 describing the Warco wheeled scoops for low-cost dirt moving, may be secured by interested contractors from the W. A. Riddell Co., Bucyrus, Ohio.

Asphalt Equipment

Chas. Hyvass & Co., Inc., 508 East 19th St., New York City, will be glad to send to those interested complete information in regard to Hyvass bituminous distributors, heavy-duty trailers, sand and chip spreaders, sweepers, sprinklers and heating kettles.

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